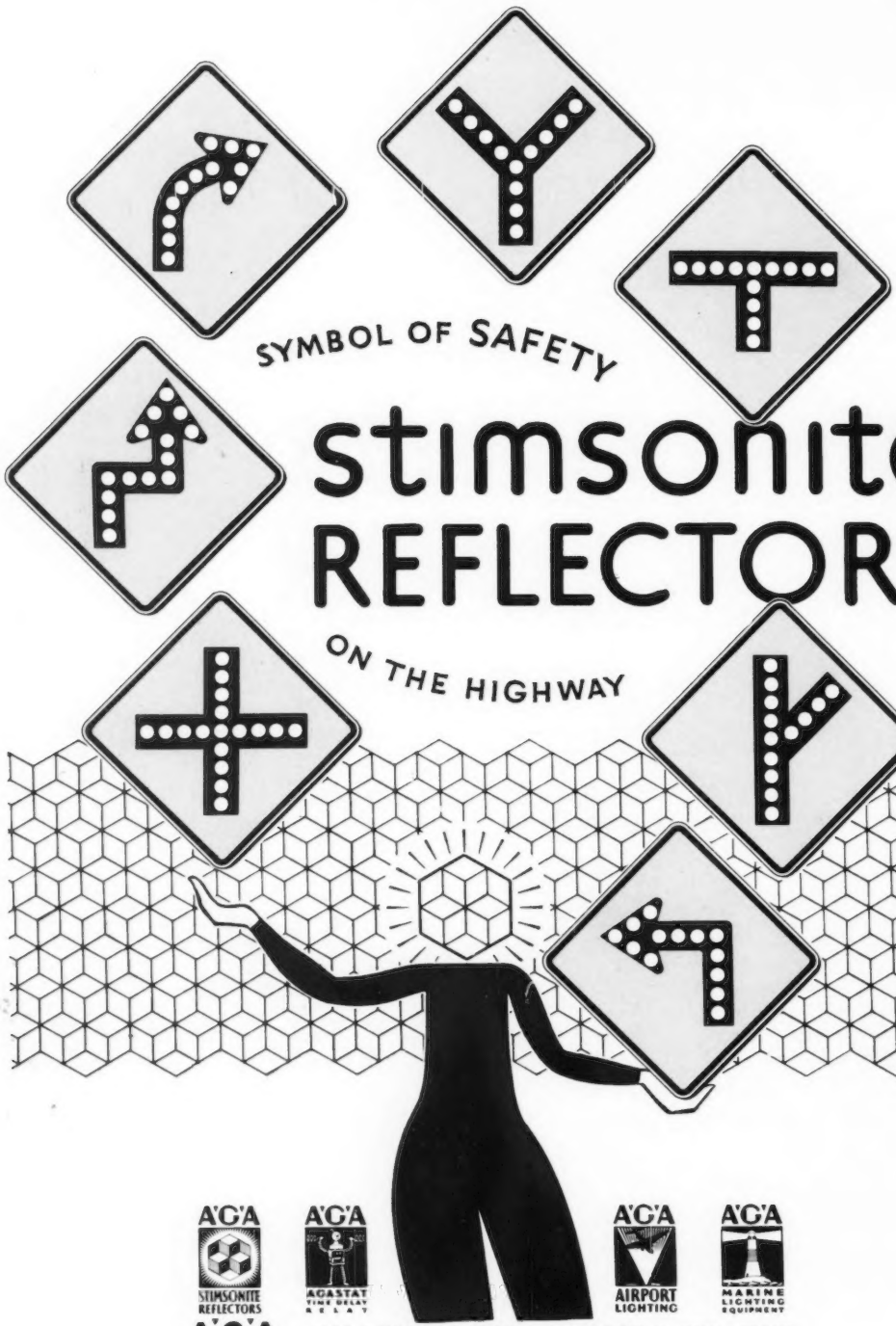
FEBRUARY, 1952

Traffic Engineering

Market-Memorial Square in Providence, Rhode Island

- Traffic Engineering Goes to Work in Providence
- Trip Frequencies and Travel Distances of Traffic on Main Highways
- The Application of Signals to Traffic Problems
- Statistical Evaluation of Origin-Destination Data
- Reference Notes

Official Publication of the Institute of Traffic Engineers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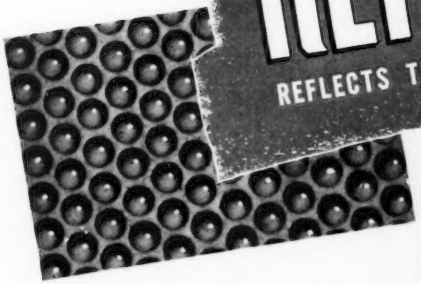

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Traffic Engineering

OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

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COVER: View showing channelization of Market-Memorial Square in the heart of the business district of Providence. This area is served by twelve important streets and its daily volume exceeds 50,000 vehicles. The channelization reduced the number of officer controlled points from six to two. See article by Dwight T. Myers.

Photo Providence Journal-Bulletin

Traffic Engineering is that phase of engineering which deals with the planning and geometric design of streets, highways, and abutting lands, and with traffic operation thereon, as their use is related to the safe, convenient, and economic transportation of persons and goods.

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What is Traffic Engineering?

THE question has never been fully answered. Some officials still think that traffic engineering is merely a branch of enforcement, a study of traffic behavior after a facility is constructed, accidents, speeds, signs, signals, and markings.

If the profession is to be placed in the proper importance among the engineering sciences, the traffic engineer must provide the officials and taxpayers with an outline, in easily understood language, of the various phases of his profession.

The definition as given in "Traffic Engineering" is all-inclusive and presents the more intricate, important phase of the profession and also the necessary studies to place controls when found necessary in the as-built facility.

The traffic engineer must have vision, but that vision must be held within the bounds of reality based on as many facts as can be determined. Before the design of any facility (highway, interchange, bridge, buildings, etc.) can be visualized for reproduction on paper, Traffic Engineering must be applied.

The question as to whether this was Civil Engineering before the new phase of Traffic Engineering was developed is not a serious issue. A new phase of engineering has been developed—it is different, it has a definite place in the sciences of engineering.

Thanks to the *Institute*, Traffic Engineering is becoming better understood. Universities and colleges are including it in their curricula.

Those engineers, who have through their efforts, individually at first, collectively later by the formation of the Institute of Traffic Engineers, established traffic engineering as such, are to be congratulated. They have brought about the recognition of a new profession.

You engineers, members of the ITE, should recognize the trust placed in your charge. In your locality you represent this new phase of engineering. By your acts and reports the dignity of the profession is impressed on those you contact.

The *Institute*, through its members, has recently voted a new type of membership. Only through the same diligence and ethics can this new type of membership in ITE be a credit to themselves and to the Traffic Engineering members. All must cooperate to see that the high quality of ethics and use is maintained. Only by such cooperation can the new type be of any value, and unless the value is measured by the ethics of the engineering profession, disastrous results might accrue.

In order that all traffic engineering members and the new type may have a clear understanding among themselves, as well as with the public, a manual setting forth the highlights of "Traffic Engineering The Profession" should be compiled and made available for distribution as soon as possible.

Director

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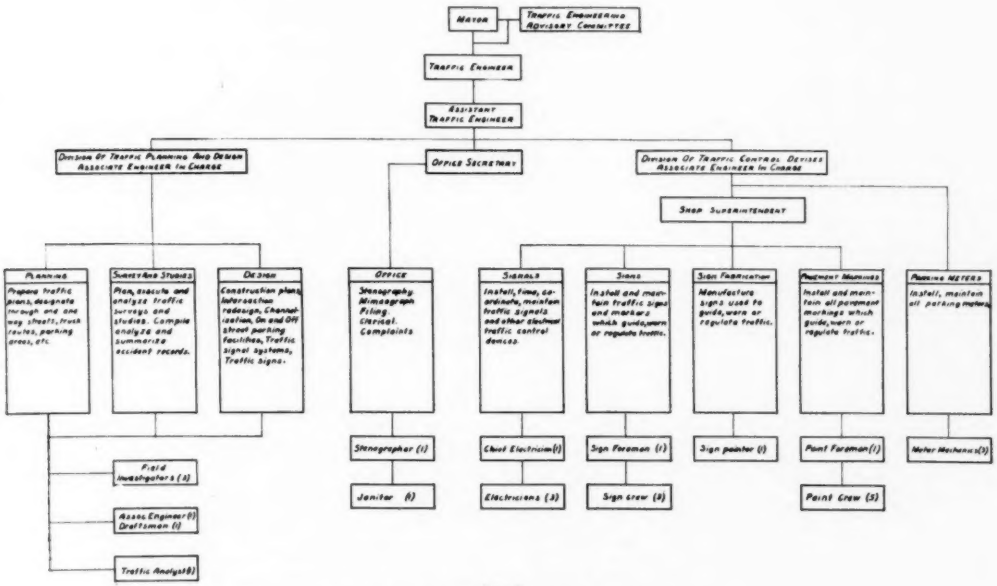
Traffic Engineering Goes to Work in Providence

By Dwight T. Myers (Mem., ITE)
Traffic Engineer, Providence, R. I.

This is the ninth in a series of articles to be published in "Traffic Engineering" magazine. Articles of a similar nature, written by traffic engineers of cities of various sizes in several parts of the country, will appear in future issues of "Traffic Engineering."

PROVIDENCE, RHODE ISLAND, with a population of 248,000 is the second largest city in New England. However, because of many contiguous cities and towns, the traffic population of the city must be reckoned at about 500,000. It is the center of one of the most densely populated areas per square mile in the United States. Providence is also one of the oldest cities in New England; and like Boston, has a very antiquated street system, which was not planned in any manner, but grew in a varied assortment of weird geometric patterns. For example, one of its principal streets, Weybosset Street, is said to have been established along a cowpath. Old Benefit Street was constructed in 1756 for the benefit of those who had built homes on the side of the hill.

Like other cities, Providence has experienced severe traffic "growing pains," and has been constantly battling the ever-increasing problems of traffic accidents and congestion. Providence is one of the first cities in the country to employ a man with the title of Traffic Engineer. Mr. Ralph Eaton, who was nationally known, assumed this position as early as 1928. Providence was known for quite a while as the safest city in the country, and established some very impressive records in that respect. Notwithstanding this excellent work that had been accomplished through the years, the Traffic Engineer had always been under a very distinct disadvantage because his work of Traffic Engineer was only one of four duties he performed under the official title of Public Service Engineer. He did not have an officially organized department with a separate budget; and all the activities regarding signs, signals, and street painting were contained in other divisions of the Government.


Mayor
Traffic Engineering Advisory Committee
Traffic Engineer
Assistant Traffic Engineer
Division Of Traffic Planning And Design Associate Engineer In Charge
Office Secretary
Division Of Traffic Control Devices Associate Engineer In Charge
Shop Superintendent
Planning
Prepare traffic plans, designate through and one way streets, truck routes, parking areas, etc.
Surveys And Studies
Plan, execute and analyze traffic surveys and studies. Compile analyze and summarize accident records.
Design
Construction plans, intersection redesign, Channelization, On and Off street parking facilities, Traffic signal systems, Traffic signs.
Office
Stenography Mimeograph Filing. Clerical. Complaints
Signals
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Signs
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Sign Fabrication
Manufacture signs used to guide, warn or regulate traffic.
Pavement Markings
Install and maintain all pavement markings which guide, warn or regulate traffic.
Parking Meters
Install, maintain all parking meters.
Field Investigators (2)
Assoc. Engineer (1) Draftsmen (1)
Traffic Analyst (1)
Stenographer (1)
Janitor (1)
Chief Electrician (1)
Electricians (3)
Sign Foreman (1)
Sign crew (2)
Sign painter (1)
Paint Foreman (1)
Paint Crew (3)
Meter Mechanics (3)

Fig. 1
City of Providence Traffic Engineering Department.

A New Traffic Engineering Department

Realizing that the traffic headaches were gradually getting worse, and that something had to be done about these problems, the City passed an enabling act which set up a new Traffic Engineering Department in the year 1948. The unique part of this legislation is that it is perhaps one of the strongest of its kind to be found anywhere in the Country. In it, the Traffic Engineer is given absolute authority to make any needful rules or regulations which he deems advisable, except that the authority to make streets one way must have the approval of the City Council. Just why this limitation was placed on this legislation, is not known to the writer, but no difficulty of any kind has been experienced to date in receiving this Councilmanic approval. However, and this is most important, in establishing any other kind of traffic rule or regulation, other than one-way streets, the Traffic Engineer is empowered to proceed immediately through his own department to have the appropriate traffic control devices installed.

The Traffic Engineer has departmental status on the level with all other City department heads, and reports directly to the Mayor *(See Figure 1)*. There is a traffic committee consisting of department heads and Police officials, which sits only in an advisory capacity. Directly under the Assistant Traffic Engineer are two principal divisions—the Division of Traffic Planning and Design, which is the office portion of the organization; and the Division of Traffic Control Devices, which is responsible for all field work. There are sixteen office employees, including the parking meter maintenance men, and 17 field employees.

The present yearly budget of the department is approximately $214,000. In addition to this budget, there is a special fund voted by the people of $400,000 for the installation of traffic signal equipment. The consulting engineering budget, which will be explained later, amounts this year to approximately $12,000.

General Activities

The new department became a reality upon the appointment of the present Traffic Engineer, who took office March 1, 1949. The general basic policy of attack has been to adhere strictly to the idea of making the best use of *existing* facilities. While we strongly support the idea of building larger facilities such as modern freeways and expressways, it must be realized that this type of construction takes time to plan and considerable sums of money to construct. While we are working towards this ultimate goal, the purpose in the meantime is to get the maximum efficiency from the existing street pattern, as far as traffic movement is concerned.

Traffic volumes in the City have been increasing at the rate of 4 per cent compounded annually; and because of the strategic position of the City with regard to defense work, trucking movements have increased beyond all expectations. We have used the usual common tools of traffic engineering—signs, signals, markings, and channelization in an attempt to wring out the very last ounce of efficiency from the archaic street pattern with which we have to deal.

Traffic Signs

When we first started, the traffic sign situation all over the City was almost deplorable. The signing had been neglected for years, and was far below the desirable standards. Approximately 6000 new signs have been manufactured and erected in the streets since we started operation. Almost all of our signs are manufactured by the department itself. Where possible, we have followed the conventional standard on signs, but our tendency has been to go to larger signs than are usually indicated at particularly difficult intersections, in order to obtain the required target value.

Signals

Before 1948, the City had approximately 45 intersections controlled by traffic signal equipment. At the end of this year we will have 110 signalized intersections. Much of the equipment is of the vehicle-actuated type, we also have a number of arteries on which we have progressive systems using fixed-time equipment. Perhaps the outstanding examples of the use of special signal equipment are at the Point Street Bridge (Burnside Square), where the traffic volumes are in excess of 45,000 vehicles daily; and at Robert Emmet Square, which is in the very heart of the downtown area, and carries well over 30,000 vehicles daily.

In 1950 the voters approved a bond issue for $400,000 to be used for traffic signal equipment, and the department is well along in a four-year program during which $100,000 will be spent yearly. This will provide for the signalization of many of the downtown intersections where we have had officer control for years.

Pavement Markings

One of the principal activities of the department has been street marking. Some idea of the extent of the program can be seen by the number of gallons of paint applied. In any one year in the past, Providence had not used more than 500 gallons of paint. At the end of the present painting season, we will have applied approximately 3500 gallons of paint. This is all reflectorized, either with the beads in the paint or applied on the surface of the painted line. Again, stressing the necessity of trying to get as much traffic through the narrow streets as possible, we have made considerable use of multiple lane lines, and it has been found that where the lanes are clearly defined and marked, the motorist will have a tendency to double up, and in so doing, increase street capacity.

Special Activities

Market-Memorial Square

Directly in the heart of the downtown business area and at the focal point of practically all our parking and traffic demands, lie two very important Squares which adjoin each other, known as Market-Memorial Square *(See front cover)*. These Squares are served by twelve important streets acting as tributaries, pouring traffic into the area. Daily total volumes here exceed 50,000 vehicles. There had been practically no control in the Squares, and with these volumes, it is easily understood how much confusion and traffic delay existed here. Recognizing that this was one of our greatest problems, and also realizing that the street system in the entire area must be repaved, the Traffic Engineering Department went to work conducting an origin and destination survey, in addition to detailed volume counts. A series of temporary channelization islands were produced in the field by means of temporary stanchions placed in paint buckets filled with concrete. The purpose of this was, of course, to test our traffic planning on a research basis before a construction project was recommended. After we were reasonably sure that these islands were in proper position, we recommended to the Public Works Department that they be constructed. Construction of approximately 34 channelization islands in the area, together with a complete new street system was completed early last year at an approximate cost of $140,000. Some idea of the extent of the work attempted here can be seen in Figure 2. The raised con-

Photo Providence Journal-Bulletin

Fig. 2
Market-Memorial Square Showing Details of Channelization.

crete islands have all been completely painted with white reflectorized paint. Again, with the use of multiple lane lines, we have been able to bring about a reasonable amount of order out of almost total chaos. One feature of the channelization is a three-way street movement in which mass transit is allowed to use this particular throat against the conventional traffic direction, protected by special channelizing islands. Perhaps because of the research that was conducted here with temporary stanchions (which are not desirable on such a large scale) the whole project was quickly dubbed "Myers' Mystic Maze." Nevertheless, it does handle extremely heavy volumes of traffic at a construction cost that was very reasonable, and it will serve until funds for the ultimate solution—grade separation—are available. In Memorial Square itself, before this construction was attempted, six officers were required at various points to move the traffic at peak hours. Point control has been reduced after construction to two locations.

Columbus Square

Columbus Square lies in the southern portion of the City, and it forms a "Y" intersection which handles very heavy volumes of main traffic arteries leading to southern points. Construction is now about completed on a series of channelization islands at this Square. *(See Figure 3).* New traffic signal equipment of the actuated type will be installed at this point, and we have just put into operation a new progressive signal system consisting of six controlled intersections leading from the Square in a southerly direction towards the City line.

Traffic-Transit Integration Survey

In appraising our traffic problems it was apparent to the department that in Providence, the problems of mass transit and other vehicles in the traffic stream were bound into a tight integral mass. Any attempt to extend the present one-way street system ran into problems involving mass transit. The same was true in the extension of the signal system, because the trackless-trolley system in use in the City presented complexing problems. There had been many plans made by both the City and the transit company, but on an individual basis, all of these plans had failed to materialize. Perhaps this was true because of a lack of realization on both sides of the mutual problems that were involved. The Traffic Engineer therefore recommended that the City enter into a joint effort with the United Electric Railways Company to have a complete study of the problem made, with the idea of determining what steps should be taken on the part of both the transit company and the City in producing a plan that would continue the policy of making the maximum use of existing facilities. A Consulting Engineering Company was retained, and the fee was equally shared by the two parties involved. The consulting engineers have very recently submitted their final report and recommendations. The report essentially recommends the extension of the one-way system, which will now make practically all streets in downtown Providence one way; the signalization of many of the more complicated intersections; and the rerouting of mass transit operations to fit into this pattern. The transit problem, as well as the traffic problem was studied in detail for a period of about eight months by the consultants. The total recommended cost of overhead wiring on the part of the transit people, and construction changes on the part of the City approximate $300,000. At this time both the City and United Electric Railways are studying these recommendations, and it is our hope that at a very early date we can move into a program of stage construction that will eventually adopt most of the recommended changes. It is believed that this effort is almost unique, and perhaps one of the very few of its kind in the Country, where mass transit officials and City officials have met around a conference table, recognizing that they have mutual complex problems which can only be solved in a cooperative effort.

Off-Street Parking

Garages—The State of Rhode Island and the City of Providence passed enabling legislation in 1950 which gave the City the authority to build, operate or lease for operation off-street parking lots and garages. The City Plan

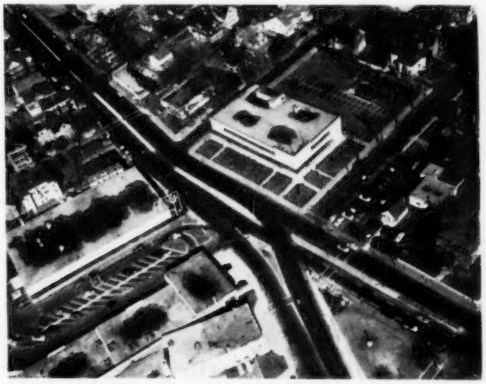


Photo Providence Journal-Bulletin

Fig. 3
Channelization of Columbus Square.

Commission, the Redevelopment Agency and the Traffic Engineering Department worked on a cooperative basis using parking data from previous U. S. Bureau of Public Roads surveys to produce a parking needs report. The report essentially shows a deficiency of 3000 parking spaces, and the reasons why the City would need to build six off-street parking garages and quite a few parking lots during the next ten years, if the parking demand were to be met within reasonable limitations. Upon recommendation of the three departments, the first stage of the construction program (the building of two garages) was recommended. The people, in the 1950 elections, approved a bond issue of $1,700,000 to provide for this first stage. The City has now retained the services of an engineering consulting firm to check on the locations of the first two garages as determined by the joint board, and to produce functional plans. The consultant's report is about to be made public, and we hope to move into the next phase—that is, production of detailed construction plans—at a very early date. Because of rising costs and because of the additional land that is required at one of the sites, it is possible that the first stage of construction will provide only one garage. Plans are now to start construction as early as possible in 1952.

Parking Plaza—The City and the State collaborated on a Federal Aid Project to improve the street system in the area immediately in back of the New Haven railroad station and directly in front of the Capitol building of the State of Rhode Island, known as Pershing Square. The plan is essentially a huge rotary, and the streets were widened so that we could have full twelve-foot operating lanes and further control by means of island channelization and signalization. The roadway system *(See Figure 4)* circumvents a large area which was originally a city park. The park has been abandoned, and the City's first Municipal parking lot has been constructed on its site. The parking lot consists of 325 metered parking spaces, and was designed in such a manner that practically all the old trees that were in the park have been retained. The outside edge of the parking plaza has been planted with trees and shrubs—the effect being eventually to screen the parking area from the roadway areas. The lot has only been opened for about two months, and has proved to be quite successful as far as public acceptance is concerned. The motorists can park here for two, three or four hours for 5 cents, 10 cents and 15 cents respectively.

Providence does not have a Parking Authority. The Traffic Engineer was recently named by City Council as Parking Director, in addition to his other duties. As Parking Director, he is now directly responsible for the operation of the new Pershing Square Parking Plaza, including responsibility of snow removal. If and when garages are built, it is probable that the Traffic Engineer will be overseer of garage operation, whether the City operates the facility or whether it is leased to private interests.

Other Activities

Traffic Regulations

As in most traffic departments the usual everyday procedure consists principally of issuing general traffic regulations. These regulations are of the usual variety—parking and stopping regulations, parking restrictions, parking time regulations, STOP and YIELD sign control locations, and special all-rolling restrictions during peak hours. The Traffic Engineer issues the regulation; and after any necessary control device is erected in the field, the Police Department is notified. The regulation then automatically becomes an addition to the general traffic laws, and is subject from that time on to Police enforcement. Once each month in one edition of the newspaper all these regulations must, by ordinance, be advertised. Since the start of operations, the department has issued approximately 700 of these traffic rules, and a large part of the office and field staff time is of course devoted to this very necessary activity.

Photo Joseph R. Marcello, Providence

Fig. 4
Pershing Square Municipal Parking Plaza.

Bus Stop Program

For years the United Electric Railways buses, and originally their street cars stopped out in the roadway to pick up and discharge passengers, the only indication of the stop being green and orange bands painted around utility poles. One of the principal efforts of the new Traffic Engineering Department has been a bus stop program. Many of the important arterial streets have been studied with respect to bus operations. These studies determined where new bus stops should be located, with a preference for far-side locations at an intersection, if at all possible. Of course, due to certain business concentrations and other fringe developments, it has been necessary at some places to adopt near-side locations at an intersection, and at other points to go to mid-block bus stops. The overall purpose of the program was to reduce the number of bus stops, if possible, and to clear out parking at the bus stop location. We feel that this program has produced remarkable results, as far as reducing delay time is concerned. Bus stops themselves are adequately signed at both ends, and in the case of unusually long stops, signs are also placed midway. The curb along the bus stop is always painted with reflectorized yellow paint.

Route Signing

For years Providence has had the unenviable but deserved reputation of being one of the worst cities to pass through in the Country, as far as route markers were concerned. One of our earliest projects was to rectify this condition. We have partially accomplished our objective by adopting jumbo route markers which are placed along the various U. S. routes at particularly advantageous points, and at enough locations so that the through motorist has no difficulty in finding his way. For these routes we have adopted colored route markers. It is believed that the program of colored route signing has been of material benefit to the through traveler, if the many congratulatory letters which we have received are any criterion.

Truck Pickup and Delivery Problems

At the suggestion of the Traffic Engineering Department, a special "Truck Pick-Up and Delivery Committee" was formed, consisting of representatives from the Chamber of Commerce, Police officials and businessmen. Without

going into detailed truck surveys, the truckers were asked to point out to this committee the principal spots where they were experiencing costly delays in the matter of pick-up and delivery. A wealth of information was received from this source, and in quite a few cases we have been able to rectify some of the difficulty by going into special regulations on loading during peak hours. Large tractor-trailer combinations have not been permitted in the concentrated downtown business areas in the City from 12 Noon until 6 P.M. for some time. In other areas, no loading or unloading is allowed between 4 P.M. and 6 P.M. The inherent problems of pick-up and delivery occur in the early morning hours, and it was this type of problem that this committee was formed to investigate. The businessmen, in addition to the truckers were told of their responsibilities with regard to efficient loading and unloading operations within their own establishments. A marked improvement has been noticed since the start of the campaign.

Parking Meters

Providence was one of the earliest cities to install parking meter, having first installed them in 1937. However, in 1939 they were removed immediately from the streets after a Supreme Court decision declared them illegal. It was not until 1947 that the parking situation became so serious that the illegal objection was removed and the meters were restored to service. In the meantime, in 1938 Providence experienced a severe hurricane and tidal wave, and all the meters then in operation were waterlogged. These meters had been in extremely poor mechanical condition, with approximately 50 per cent of them not in working condition. One of our first acts was to change the entire parking meter maintenance program. This was accomplished by dividing the metered areas into three separate districts, with a man given complete charge of winding and maintenance of every meter in his area. A rehabilitation program to trade in the old meters for new ones was also started. At the end of this year, about 1646 meters will be in operation. Less than one hundred of these remain to be replaced with new meters. The effect of this program has been to reduce service and maintenance costs to a minimum, and at the same time, has increased parking meter revenue from about $1800 per week in 1949 to $3000 per week at the present time.

Accident Analysis

A new Accident Analysis Section was set up in the department beginning January 1, 1950. We now have the most complete coverage of accident reporting of any agency in the State of Rhode Island. The accident reports are received from all possible sources, including the Police, State Department of Motor Vehicles, all public transportation companies, etc. We have adopted the recommended short accident reporting form of the National Safety Council, and have now succeeded in getting this form in general use throughout the entire State. This procedure has paid off in engineering analyses at many locations. While we only have a comparatively short period of time reported in our accident records, even at this early date we are able to use the information to great advantage in making traffic decisions.

Highway Planning

We are now working with other City agencies, such as the City Plan Commission and the Redevelopment Agency, and also with the State Department of Public Works in planning for the construction of the first two sections of Providence's first Freeway. The Olneyville Expressway, which is a mile in length and will cost approximately $9,000,000 is approaching completion. Much of our staff time has been used in the past year to develop further traffic facilities of the latest modern design.

Maintenance Shop

One of our first projects as an operating traffic department was to obtain a traffic shop from which to conduct our field activities. This year should see the completion of the remodeling of an existing City building in which we will house all our sign and signal equipment, as well as all our trucking equipment.

Liaison With the Police Department

The department has received steadfast support from the local Police Department. Almost daily we confer with the traffic division of the Police Department to seek the solution to our many allied problems that must be dealt with on a day-to-day basis.

Public Relations

One of the highlights of any organized departmental effort in traffic engineering is its public relations effort. Fortunately we have enjoyed cooperation to the fullest extent from the local Press, and this, in a large measure has been a great help in acquainting the public with the purpose behind our many plans and regulations. The radio and television have also been very cooperative, and we have used them to the fullest degree possible.

We have developed an extensive colored-slide film library showing "before and after" conditions at numerous locations. These pictures are taken with a Stereo-Realist camera. This has proved to be very acceptable on the part of the public, especially in the case of service clubs, where many presentations have been made.

Conclusion

Our plans for the future are two-fold. First, we want to get into actual operation a large number of the recommendations contained in the recent Traffic-Transit Integration Survey. Secondly, we will work with all agencies of Government to insure the early start of the Providence Freeway. It is believed that an appreciable start has been made toward the goal of modern traffic control in Providence, and there is every reason to believe that we can push these proposed plans further in the ensuing years, so that the time will come when people can no longer talk too much about Providence's "terrible traffic problems." I think we will all agree that as traffic volumes continue to increase, and as the miles traveled per year and car production increase, it will take constant efficient attention to the problem to keep abreast of the situation. In our opinion any success which we may have had up to now in our traffic efforts in Providence has been due solely to three reasons.

1. Enabling legislation that gave the Traffic Engineer absolute authority to make and put into effect any regulation that he deems necessary. Authority as complete as this must be handled with great care and tact; but it does have the tremendous advantage of "getting the job done."

2. The support of the City Government and the Mayor in providing sufficient funds and personnel to do the job; and also their complete cooperation in backing up almost all the decisions that have been made to date.

3. Cooperation of the Press and the general public in realizing that the situation needs correcting, and that it requires sacrifice and understanding if we are to continue to make progress.

Trip Frequencies and Travel Distances of Traffic on Main Highways

By Elmer B. Isaak*
Consulting Engineer, Engineer-in-charge, New York State Thruway Traffic Survey

NEW light on where traffic comes from has been shed by an extensive survey just completed for the New York State Thruway. Commuters and regular drivers, who pile up tremendous numbers of trips in the course of a year, actually comprise a very small portion of the motoring public on the main state highways. On the other hand, at least four out of five of the individual vehicles using a typical main highway during a year are making occasional trips.

Because of proposals to include an annual permit in the Thruway's schedule of user fees, it was necessary to obtain information on the frequency of travel by individual vehicles. This was accomplished in conjunction with the origin and destination traffic survey by adding the question, "How many times a year do you make this trip?"

Scope of Study

Some 376,000 replies were obtained to the questionnaire, representing a 25 per cent sample of the 1,520,000 vehicles actually counted as passing the survey stations during the periods of the check. The replies were obtained principally by interviewing drivers in their vehicles, and the survey sample covered weekday and Sunday traffic under different seasonal conditions.

The stations selected for the survey were all outside of cities on main state highways, the principal routes covered being U. S. 20, N. Y. 5 and N. Y. 17 across New York State, Route U. S. 9W between Albany and the New York City area and all the Hudson River crossings between New York City and Albany. In all, 49 locations were covered, including 41 highway stations, five bridges and three ferries. The results may therefore be considered indicative of typical conditions on main rural highways connecting large cities, but they do not reflect urban characteristics.

Trip Frequencies

All trips considered as potential Thruway users were analyzed in detail. These include most of the trips traveling along the main highways for at least a few miles, but very short trips and trips whose principal direction was across the main highway were eliminated. As a result of the trip frequency analysis of potential Thruway traffic, two striking conclusions stand out:

1. A very small number of regular drivers on a particular highway account for a very substantial portion of the total traffic volume.
2. The overwhelming majority of individual vehicles on a particular highway during the course of a year are making occasional trips.

Passenger car trips traveling along the main highways covered, and considered potential to the Thruway, were at the estimated annual rate of 59,700,000. Of these about 15,100,000 trips were found to be made by cars traveling with commuting frequencies of five times a week or more. The number of individual vehicles in this group was only 28,000, which was less than one per cent of all the individual automobiles represented but they accounted for about 29 per cent of all the passenger car trips covered by the study.

Trips By Individual Vehicles

The great majority of individual vehicles using the main highways in New York State were found to be occasional travelers making trips occurring only one to four times a year. In order to give quantitative expression to this fact, it is necessary to use a term designating all trips made by an individual vehicle between two particular points during the course of a year. The term "vehicle run" has been adopted to apply to this value. A vehicle run may represent one trip or five hundred trips between any two points by one vehicle. Obviously a single vehicle may make several vehicle runs on a given highway in a year, but it is unlikely that more than one of these will be of high frequency.

Of a total of approximately 5,130,000 different vehicle runs per year estimated to be made by potential passenger car users of the Thruway, nearly 3,665,000 runs consisted of one round trip each. These unrepeated trips constituted only 12 per cent of the total traffic volume covered, but they accounted for about 71 per cent of all the vehicle runs made. Another 16 per cent of all vehicle runs represented only two to four round trips per year each, accounting for about 8 per cent of the total trip volume.

Once a vehicle starts to travel a given route with a frequency of one or more trips a month, it begins to play a greater-than-average role in the traffic picture on that highway. Weekly trips, for example, accounted for over 15 per cent of the traffic volume recorded in the survey, although less than two per cent of the vehicle runs were in this category.

All trips made more often than once a week, including commuters, accounted for 45 per cent of the traffic volume but only 1.3 per cent of the vehicle runs. Trips with commuting frequencies of five times a week or more, producing 29 per cent of the traffic volume, involved only 0.5 per cent of the total vehicle runs. This rather startling result illustrates the tremendous ability of a few vehicles, traveling regularly, to pile up large traffic volumes. Stated in the simplest terms, one car traveling daily makes 365 trips a year, but it requires 365 different cars making one trip a year to reach an equivalent total.

*Mr. Isaac presented this paper at the November 29, 1951 meeting of the New York Section of the *Institute*.

A more detailed breakdown of the trip frequency groupings is shown in the table following:

Table 1
PASSENGER CAR TRIPS IN EACH TRIP FREQUENCY BRACKET COMPARED WITH NUMBER OF DIFFERENT PASSENGER CAR RUNS

No. of Trips Per Year	Total One-Way Trips		Number of Different Vehicle Runs	
	Number	% of Total	Number	% of Total
1	7,329,000	12.3%	3,665,000	71.4%
2-4	4,958,000	8.3	826,000	16.1
5-8	2,073,000	3.5	173,000	3.4
9-17	5,534,000	9.2	231,000	4.5
18-34	3,806,000	6.4	76,000	1.5
35-70	9,086,000	15.2	95,000	1.8
71-135	5,063,000	8.5	25,000	0.5
136-225	4,772,000	8.0	14,000	0.3
226-280	4,971,000	11.7	14,000	0.3
281-325	4,854,000	8.1	8,000	0.1
326-375	2,225,000	3.7	3,000	0.05
Over 375	3,035,000	5.1	3,000	0.05
TOTALS	59,706,000	100.0%	5,133,000	100.0%

It is seen from Table 1 that the 59,706,000 trips are fairly well distributed among the twelve trip frequency groupings. For the average day, taking into account both weekdays and Sundays, this distribution of trip frequencies would be fairly typical.

Distribution of Vehicle Runs

The distribution of vehicle runs, however, is extremely unbalanced, with the great concentration being in the low frequency brackets. In the course of a year, each vehicle making only one trip annually must have 364 counterparts to account for one trip per day. Likewise, it requires about 120 vehicles making three trips a year to build up one trip a day. At the other end of the scale, each regular commuter very nearly accounts for a trip each day. As a result, the 14,000 most frequent travelers made more trips in a year than were recorded by all the 3,665,000 vehicle runs which consisted of only one trip each.

In Chart A, the left hand circle shows the distribution of annual trips, whereas the right hand circle deals with the corresponding vehicle runs. The striking preponderance of low frequency vehicle runs points up the importance of the occasional user on the highway. At the same time, the disproportionately large share of the total traffic volume built up by regular travelers and commuters is brought out.

Commuter Traffic

The number of individual commuters and frequent travelers covered by the survey, estimated at about 28,000, may seem very small in proportion to the total volume of traffic involved. Since these vehicles made approximately 29 per cent of the total trips moving along the highways surveyed, it would require only about 100,000 vehicles traveling with similar frequencies to account for all the traffic. This would obviously be an absurd assumption, since it is common knowledge that many occasional trips occur, and yet even 100,000 vehicles are a small percentage of the total number operating in the New York State area covered by the survey. This area, incidentally, does not include the New York City commuting territory, as no survey stations were located there. It does cover the areas surrounding most of the other important cities of the state.

The Regional Plan Association of New York recently estimated that there are only 10,000 automobile commuters to the central area of New York City from Westchester County and Connecticut. The annual traffic volume moving on main highways between the city and this sector is in the neighborhood of 40,000,000. Assuming that commuters to

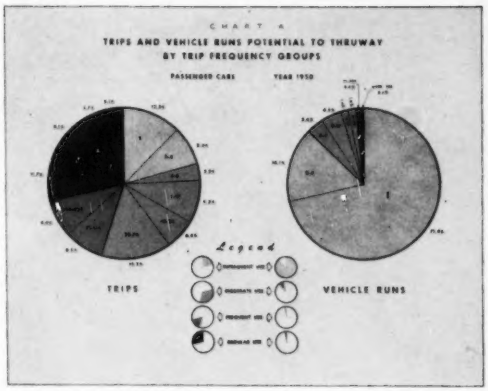


CHART A

the downtown district make 300 round trips per year, they would account for about 15 per cent of the total volume. Similar relationships occur for the Long Island and New Jersey commuting areas of the New York region.

The nature of commuting traffic has apparently been the subject of considerable misunderstanding. Whereas statements have frequently been made that a million or even more persons travel daily into New York City, the Regional Plan Association's recent report shows that only about 350,000 commuters move to the central area by all means of transportation, including rail, auto and bus.

The commuting problem seems to lie not in an excessive number of commuters, but rather in the concentration of their movements within a very short period of time. On the highways, nearly one-fourth of the traffic volume, concentrated into roughly one-eighth of the time, is built up by the repeated trips of less than one per cent of the individual vehicles traveling a given route. This is one key aspect of the picture.

On the other hand, the vast majority of individual passenger car runs, representing nearly another quarter of the total volume of trips, are made only once or a few times a year. In between, roughly half of the trips are accumulated by non-commuting drivers traveling with some frequency, ranging from about once a month to three or four times a week. On the main highway network, the overwhelming preponderance of individual vehicles traveling are engaged in occasional and non-commuting trips.

Trip Frequencies of Commercial Vehicles

Similar studies for light and heavy trucks also reveal some interesting characteristics, which apply to main highway traffic potential to the Thruway but not necessarily to local or strictly urban movements.

About 48 per cent of all movements by heavy trucks were found to be repeated from once a week to four times a week. This reflects normal operating practices for over-the-road truckers. More frequent trips accounted for 33 per cent of the total volume, whereas occasional trips made less than once a week tallied up to only 19 per cent of the total.

Light commercial vehicles in the delivery truck class show a greater tendency to higher repetitive trips. The survey showed that 42 per cent of all trips were made five times a week or more, with some vehicles traveling the same route two or three times a day. Another 37 per cent

Table 2

COMMERCIAL VEHICLE TRIPS AND VEHICLE RUNS IN EACH TRIP FREQUENCY BRACKET

No. of Trips Per Year	LIGHT TRUCKS				HEAVY TRUCKS			
	Trips		Vehicle Runs		Trips		Vehicle Runs	
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
1	153,000	4.3%	76,500	61.4%	235,000	4.1%	117,500	61.7%
2-4	111,000	3.1	18,500	14.8	172,000	3.0	28,700	15.1
5-8	82,000	2.3	6,800	5.5	94,000	1.7	7,800	4.1
9-17	201,000	5.6	8,400	6.8	283,000	5.0	11,800	6.2
18-34	193,000	5.4	3,900	3.1	287,000	5.1	5,700	3.0
35-70	475,000	13.3	4,900	3.9	831,000	14.7	8,700	4.5
71-135	380,000	10.6	1,900	1.5	889,000	15.7	4,400	2.3
136-225	476,000	13.3	1,400	1.1	1,021,000	18.0	3,100	1.6
226-280	336,000	9.4	700	0.6	514,000	9.1	1,000	0.5
281-325	531,000	14.9	900	0.7	558,000	9.8	900	0.5
326-375	274,000	7.7	400	0.3	300,000	5.3	400	0.2
over 375	361,000	10.1	400	0.3	480,000	8.5	500	0.3
Total	3,573,000	100.0%	124,700	100.0%	5,664,000	100.0%	190,500	100.0%

of the trips were repeated from one to four times a week, but the balance of occasional trips still accounted for 21 per cent.

In spite of the tendency of commercial vehicles to travel on regular routes, they do make substantial numbers of occasional trips. During the course of a year, about five out of eight truck runs on the main highways are unrepeated, and another one out of eight runs is made only two to four times a year. Nevertheless, more than four-fifths of all trucking trip volumes are built up by the runs repeated once a week or more. These truck runs include only nine per cent of those made by all trucks.

A breakdown of the number of one-way trips and vehicle runs in each frequency bracket is shown in Table 2.

Travel Distances

Analysis of the origins and destinations of traffic traveling along main state highways and potential to the Thruway afforded an opportunity to determine the distances traveled by various classes of vehicles, and also to correlate travel distances with trip frequencies.

As has been noted by numerous previous surveys, most trips are short. Over 60 per cent of all passenger car trips were for less than 25 miles, and 74 per cent were for under 50 miles. Less than 12 per cent of passenger car trips along the main highway extended for more than 100 miles, and less than six per cent were for over 200 miles.

Further insight into the nature of passenger car travel is gained by examining the types of trips being made, as revealed by the survey. Most trips did not pass the next large city,[1] and the majority were to or from cities. Trips between two large cities, however, were not so numerous as might have been supposed.

Following is a summary of the distribution of passenger car trips according to categories of origin and destination:

Distribution of Passenger Car Trips

78% of the trips were short—Not beyond the next large city
Distributed as follows:

City to City	21%
Rural to City	59
Rural to Rural	20
	100%

22% of the trips were longer—Beyond the next large city
Distributed as follows:

City to City	15%
Rural to City	53
Rural to Rural	32
	100%

100% All Passenger Car Trips
Distributed as follows:

City to City	20%
Rural to City	58
Rural to Rural	22
	100%

Table 3 shows the distribution of passenger car, light truck and heavy truck trips according to distance groups.

Relation of Travel Distances to Trip Frequencies

It is logical to expect that long trips will be made infrequently, and that frequently repeated trips will be short. A correlation between travel distances and trip frequencies has been developed for trips expected to be diverted to the Thruway, and the results are depicted graphically in Chart B. The traffic covered in this chart does not include all potential trips, but only those expected to be Thruway users.

In the lowest frequency bracket of unrepeated trips, the average trip distance is 170 miles. Trips made from two to four times a year average 105 miles, and as the frequency increases the distance steadily decreases. In the high frequency brackets of five trips a week or more, the average travel distance is about 20 miles. These mileage figures refer to the total travel distances of trips now being made, but expected to be diverted to the Thruway when it is opened.

[1]For purposes of classification, the following were considered large cities: Buffalo, Niagara Falls, Rochester, Syracuse, Auburn, Utica, Amsterdam, Schenectady, Albany, Troy, Kingston, Poughkeepsie, Newburgh area and New York.

Table 3

TOTAL TRAVEL DISTANCES OF POTENTIAL THRUWAY TRIPS
AS DETERMINED BY 1950 TRAFFIC SURVEY

Total Distance Traveled (Miles)	Passenger Car Trips		Light Truck Trips		Heavy Truck Trips	
	Number	% of Total	Number	% of Total	Number	% of Total
0-50	43,971,000	73.6%	3,011,000	84.3%	2,335,000	41.2%
50-100	9,136,000	15.3	373,000	10.4	1,341,000	23.7
100-150	2,127,000	3.6	54,000	1.5	395,000	7.0
150-200	1,365,000	2.3	43,000	1.2	402,000	7.1
200-300	1,299,000	2.2	33,000	0.9	478,000	8.4
300-400	1,046,000	1.7	28,000	0.8	406,000	7.2
over 400	762,000	1.3	31,000	0.9	307,000	5.4
Totals	59,706,000	100.0%	3,573,000	100.0%	5,664,000	100.0%

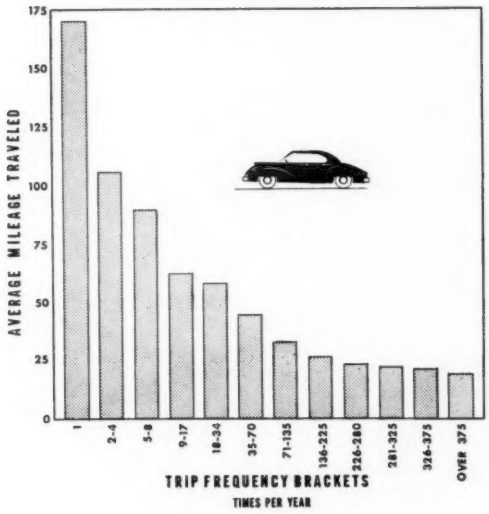
Summary

As a result of the analysis of potential Thruway trips, four principal characteristics of main highway traffic stand out:

1. A very small percentage of the individual vehicles on the road accounts for a substantial portion of the total traffic.
2. Most of the individual vehicles traveling along a particular highway during the course of a year are engaged in occasional trips.
3. The great majority of trips on main highways are short, but a small percentage of passenger cars and a considerably larger percentage of trucks make longer trips.
4. Length of trip decreases as frequency increases.

CHART B

AVERAGE TOTAL TRAVEL DISTANCE OF THRUWAY PASSENGER CAR TRIPS IN EACH FREQUENCY BRACKET



Governors Request More Steel for Highways

Requesting more steel for highways the Governors or their representatives from 45 states met recently in Washington with Defense Secretary Robert E. Lovett, Charles E. Wilson, Mobiliation Director, and Defense Production Administrator Manley Fleischmann.

Calling attention to the 20% of the total steel supply going to defense the state executives maintained that 2½% of the balance would meet the need for construction and maintenance during the emergency. However, Mr. Fleischmann advised them that the real pinch was in structural shapes and that for that item the defense demand is close to 80% leaving only a small percentage for non-defense programs.

Although the Governors and other state executives argued that highways ought not to be classified in the non-defense program inasmuch as they provided the facility for delivery of raw materials and furnished products for the defense program, Mr. Wilson's answer was that they would authorize steel for highways that threatened to break down but not for new four-lane roads.

The defense authorities suggested a possible redistribution of steel allocations among the public program but none of the state officials would agree to take structural steel from schools, hospitals or other public buildings in order to provide more steel for highways.

The conference concluded when Mr. Wilson and Mr. Fleischmann promised to review the system of allocations after the state executives suggested that more steel for highways might be had through a reexamination of non-essential programs.

MEMBERSHIP INFORMATION

may be obtained by writing to:

Executive Secretary
Institute of Traffic Engineers
Strathcona Hall
New Haven 11, Connecticut

The Application of Signals to Traffic Problems

By Holden M. LeRoy (Mem., ITE)*
Senior Associate Traffic Engineer, Traffic Engineering Bureau, Detroit, Michigan

My experience has indicated that there are few of the 56 million "traffic engineers" driving cars who do not believe that there is no problem involving traffic which cannot be corrected by the installation of a traffic signal. In fact, we once had a man request a signal installation so the corner would look busier and make it possible for him to rent his vacant store. These views, of course, are far from true. Signals unless properly installed and under the necessary warrants can result in a worse condition than previously existed. This has been demonstrated too often to be open to question.

Traffic signals when properly used are, however, one of the most valuable and effective tools which the traffic engineer has at his disposal in expediting and safeguarding traffic flow.

Ingenious Signal Devices Developed

I should like to discuss first some of the ways in which Detroit made old equipment meet the traffic problems better during the war years. During the years of World War II traffic was at a low ebb. The Detroit traffic index is based on volumes in 1941 being considered as 100. This index in Detroit had reached a low of 78 in 1944 which, of course, indicated a large drop in traffic on the streets. This traffic which was left was of extreme importance to the war effort. It has often been said that the streets in Detroit are a very real part of the assembly lines of our factories. The plants of many firms are scattered over the Metropolitan Area and partially fabricated parts are trucked from plant to plant. In addition to this the workers who are employed on one side of town all seem to live on the other and vice versa. Very large peaks of traffic occur on all major arteries when shifts change.

Due to the tremendous war effort it became of extreme importance to do everything possible to move this traffic quickly, smoothly and safely. Detroit, like many cities, had more or less been coasting along in signal work due to difficulty in getting officials to see the need and appropriate sufficient funds. Most of our signal equipment was at that time from 15 to 20 years old and much of it was induction motor driven and operating without interconnection or master supervision. This resulted in a hit or miss type of operation on the streets and many needless stops with consequent delay.

Obtaining new control equipment, interconnecting cable and other such material was virtually impossible due to shortages, priorities, etc. It became necessary to develop temporary and more or less makeshift ways of obtaining coordination along our major arteries in order to cut waste of time, gasoline and rubber. Many ingenious devices were developed and employed by the engineers handling these matters.

The first problem was to obtain synchronous operation of this control equipment in order to make possible the progressive timing of signals along the streets. Almost all of this equipment was the induction disc motor type wherein the disc was driven during each period of the cycle by different driving coils. A small synchronous, two circuit time switch was connected into the circuit of this controller so that the cycle and percentage split between the two streets was established thereon and the induction motor became merely a switching device to change the colors. In other words each local controller was in effect equipped with its own synchronous master. These devices being synchronous hold a fixed relationship to each other along a street unless a power interruption occurs.

Another difficulty frequently encountered in setting up progressive timing through a series of non-interconnected signal controllers is the cumulative error in establishing offsets between controllers as you move out the street. Accurate setting of offsets is important in timing a progressive system. The human error in operating the stop watch when accumulated through several signals may amount to enough to throw off progression in the reverse direction. Also, difficulty arises often in the inability to see one signal from the other where distances are large or a turn in the roadway intervenes.

The only way to overcome this is to refer all offsets to a common reference point rather than to an adjacent location. To accomplish this a series of gongs were established in the maintenance shop; one for each cycle length in operation in the city. These were operated by synchronous timers so as to ring once each cycle. All offsets on the street were established as a given number of seconds after the proper time signal. These time signals could be picked up over either Bell or Police telephone systems and the timings established therefrom. This enabled very accurate timing of offsets and considerably improved movement of traffic. Beneficial results were obtained in setting up progression on streets where signals were even a half-mile or a mile apart. This, of course, is considerably over the generally considered maximum of around 1200 feet. It was found that the through platoons of traffic on the street fitted quite well into the signal timing and were required to make fewer stops.

Improved Signal Maintenance

During this same period of time maintenance procedures were established and improved to provide for greater con-

*This paper was delivered by Mr. LeRoy at the New England Seminar held on November 13, 14th, 1951 at the Massachusetts Institute of Technology, Cambridge, Massachusetts.

tinuity in the operation of signals. It has been the opinion of those responsible in Detroit that if a signal is to control a given location everything possible should be done to assure proper operation. A routine relamping and cleaning schedule is followed, which replaces each lamp short of its normal rated life. Sixty watt traffic signal bulbs with a rated life of 2000 hours are used. This has resulted in an average daily intermediate burn out rate of only about eight lamps with a total of over 23,000 in operation. All signals are either operating in a "go-stop" sequence or as flashers which removes any doubt from the driver's mind as to whether a signal is out of order or intentionally not operating.

Routine inspection and tests of all control equipment at regular intervals is also made to discover potential trouble before it actually develops. All of this has resulted in a well operated system on our streets. As stated, during the war years this was of considerable value in the war effort.

Signal Improvement Program

At the end of the war we were far behind in modernizing and replacing obsolete equipment as well as in the installation of needed new signalization. We are still attempting to catch up. During this process of trying to catch up we have been faced with a steady and rapid increase of traffic. Many shifts in the traffic pattern have also occurred. The traffic index which was 100 in 1941 and 78 in 1944 has risen to 138 as of today. This has, of course, increased the need and demand for new and improved signalization. Whereas, before and during the war we were operating on a signal budget of $100,000 per year we have reached this current year a budget of $735,000 for traffic signal work.

In applying traffic signals to our present traffic problems with sums such as this available we are following a program which falls naturally into three parts, as follows:

1. New installations
2. Improvement of signal visibility
3. Modernization of old control equipment

I should like to discuss each of these as we are carrying them out in Detroit and will endeavor to explain specific examples and cite results obtained over the past few years.

Warrants for New Installations

As stated before, signal control is one of the most valuable tools available to the traffic engineer. It must be properly used if the desired results are to be obtained. The Manual on Uniform Traffic Control Devices which has been developed by traffic authorities sets forth certain warrants which should be met before signalization is applied. Our experience in Detroit indicated a number of years ago that a combination of these in varying degrees existed at any given location and a composite picture of all of them was really needed. A method was developed which enabled a combined warrant to be determined for each intersection under study. Conditions of volumes, accidents, etc. are weighed against the warrant factors and a value assigned. The total of these values is the combined warrant factor. If sufficiently high, the signal is considered warranted and scheduled in the order in which its warrant relates to others.

Where installations are based on these determinations and are properly installed and operated the desired results are obtained. A signal forcibly assigns the right-of-way to alternate streams of traffic. If at all possible it should be so located as to do this by stopping a minimum number of vehicles. Where large numbers are required to stop for the red light, accidents, particularly rear-end, are bound to happen. Congestion will also often result. This means spacing of signals should be such as to fit progressive timing wherever possible. From this standpoint politics can have no good effect as a signal warrant. If signals are installed for political reasons at improper locations, it is safe to predict sad results.

Signal Visibility

The great increase in use of large buses, trucks, etc. has made inadequate the corner-post or curb mounted signal as a sole traffic control device. They cannot be seen from a distance for intelligent driving and are often hidden from view at the most strategic instant resulting in unintentional red light violations.

To overcome this condition Detroit has been following for some years the policy of supplementing these curb signals with over-the-roadway signals mounted on mast arms or span wires. For the most part two overhead indications have been installed for each direction of travel with sufficient curb signals to properly augment them and provide adequate pedestrian indications.[1] It is felt that where any volume of pedestrian traffic is present an indication should be placed at each end of each crosswalk so the pedestrian can see the signal without having to take his gaze away from his normal line of travel.

All new installations have been made on this basis. A program of thus modernizing old installations has been carried on each year as appropriations would allow. Plans now being prepared call for treating in this manner the remaining 345 intersections during the next four years at a cost of about $1,300,000. That this policy has proven its own worth I think can be demonstrated by the following facts.

A before and after study of accidents at 40 locations so treated was made a few years ago. These were locations which had been signalized for a number of years. New mast arm vehicle indications were added and some rearrangement of curb indications was made. No other changes of any physical nature took place. This study indicated that at these 40 locations the year following completion as compared to the year before showed a 40% reduction in right angle accidents, and a 36% reduction in pedestrian accidents. During this same period volumes were steadily increasing and the City-wide accident rate had increased 18%. Since then a considerable number of intersections have dropped from high on the list of 25 worst accident locations to well below the bottom of the list with the entire credit due to signal improvements.

At first considerable criticism was voiced over the "Christmas-tree" effect but this has gradually subsided and more and more requests are now being received along this line. The results have not been only accident reduction. The ability to see approaching signals from some distance away enables more intelligent driving with fewer stops and quicker starts with reduced congestion.

Signal Modernization

The third step in Detroit's program involves the modernizing of control equipment most of which is 20 years or more old. It is completely inflexible and inadequate to

[1]See January issue of *Traffic Engineering*: Fig. No. 2, "Putting Traffic Engineering to Work" in Detroit, by A. F. Malo, Traffic Engineer, Detroit.

meet present day traffic needs even after receiving the interim war time treatment previously mentioned.

This program involves, on major arteries, the installation of triple-offset, multi-dial equipment connected to a flexible master control and program device. In other locations single dial equipment usually equipped with triple-offset, is used. In many cases this will be interconnected but not in all. The use of this type of equipment makes it possible to fit signal operation to changes in the traffic pattern and thus make more efficient use of the street system.

The first such installation was completed on approximately 5 miles of one of our heaviest arteries in about 1947. It included 18 intersections and enabled the use of an extended cycle with a change in percentage split at each intersection during the rush hours. Progression was also established to favor completely the direction of heaviest flow during these hours with a compromise setting during the base of the day. This system provided a considerable improvement in traffic flow reducing the running time and congestion. As a result volumes began to increase to the point where congestion again appeared.

At about this time a change in administration took place. This street had been an issue in the campaign and changes were immediately ordered in the signal system. These changes have very graphically shown what can happen from a wrong approach to signal control. All signals for a ten mile stretch were ordered placed on a simultaneous operation on a 90 second cycle with a 55 second green for the main street. In addition some 30 signals were added to the 30 already in existence resulting in a signal about every three blocks. The results of this system are described in the September, 1951 issue of *Traffic Engineering Magazine* in an article entitled "Statistical Instruments for Traffic Engineers" by Charles E. Haley. The figures on reduced average speeds coupled with more speed limit violation and lower gasoline mileage indicate the significant difference in traffic operations and economy caused by signal timing.

Since that time another flexible progressive system has been installed on Woodward Avenue and several adjacent streets forming a grid about mid-way on Woodward. Controllers equipped with two dials with possible expansion to three were used. Triple offset is provided on each dial. At the present time 37 intersections are included in this system. During the base periods a 50 second cycle is used with two way progression. During the rush hours the cycle is increased to 70 seconds with progression set to completely favor the direction of heavy flow. The whole system is interconnected to a synchronous master controller which is equipped with a weekly program drum. By proper use of this program drum changes in the traffic pattern on holidays and for other special events can be cared for.

This system has been in operation for too short a time for actual figures to be available. A marked reduction in congestion and running time has been evident, however. It is planned in the future to connect signals on adjacent streets to this same system.

Current Signal Installation Plans

Our plans for the current fiscal year call for installation of similar equipment in our entire downtown loop area consisting of some 140 intersections. These will be supervised by two master controllers and cascade relay stations all tied together. The principal difference in this system will be the inclusion of the third dial from the start. This is being done to make possible the shift to a longer than normal cycle in winter on icy, slippery days when driving and starting speeds are of necessity slower. The shift to the long cycle will be made with no change from normal in offsets. This, of course, will automatically lower the progressive speed for which the signals are set and thus better fit traffic conditions.

This was done one slippery winter day on the first progressive system described. Where congestion and delay existed on almost all other thoroughfares conditions appeared very near normal on this street.

Special Signal Problems

So far I have described the plan being followed in applying signal control to our traffic problems from the overall standpoint. I would like to devote the remaining space to some specific problems which we have handled with special treatment not always in the orthodox manner. I don't think anyone should hesitate to do this if careful study and analysis indicates the possibility of good results. Our experience would be that the motorist catches on quickly if the control is reasonable and clear.

The first of these involved a jog intersection in which two rather heavy left turns crossed. The major departure from standard practice involved the use at one control point of two signal heads facing the same direction and side by side. One face was equipped with vertical arrows in all three color positions and the other with left arrows in all positions. When the green left arrow was illuminated it flashed. These signals served as secondary indications at the far half of the jog in one direction. The vertical arrows governed the through movement and, because they were offset in their operation from the main signal, usually only stopped right turns from the cross street. This was necessary to adequately protect a pedestrian crosswalk. The left arrows governed a left turn off of the main street and operated with the cross street phase. This latter fact was the reason for flashing the green arrow in order to indicate caution because of possible conflict.

Virtually from the moment this signal was turned on traffic behaved properly evidently understanding the intended meaning. It has now been in operation in this same manner for several years.

Another of these variations from standard involved the use of semi-actuation. In this case the detectors were installed on the major street with automatic return periodically to the cross street. In this manner the heavy flow of traffic was given control of the signal and it was not so apt to be interrupted at the peak of a platoon by a call from the cross street. The main street green period was extendible from 35 seconds up to a maximum of 70 seconds. The cross street period was fixed at 25 seconds. Virtually no difficulty had been encountered by the heavy main street traffic at this point although good fixed time coordination would not have been possible.

A number of signals have had to be installed at locations so close to railroad crossings or lift bridges that interconnection to the crossing protection was required. This has required careful study and application of special circuits, arrow indications, etc. but safe and efficient operation has resulted insofar as grade-crossing operation will allow.

Pedestrian Indications

Too much of the thinking has been devoted to vehicular control in most locations. The pedestrian has been almost

(Continued on page 187)

Statistical Evaluation Of Origin-Destination Data

By Orman K. Anderson (Jun. Mem., ITE)
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VARIOUS practices have been followed in conducting Origin-Destination surveys and in the interpretation and application of results. Urgent need for factual information for planning and design, not to mention factors of time, cost, personnel, etc., has not permitted the continuing accumulation of such data for a given route or area, as has been possible with volume and classification data.

Traffic engineers recognized that in this field of traffic analysis, as in perhaps no other phase of engineering and planning work, there exists such a complex multitude of variable factors that accurate definition of characteristics would require unreasonable and unjustifiable amounts of time, money, and personnel. Consequently, they have been forced into the position (for which they have been criticized in some quarters) of taking a sample at a given time, preferably under average or "prevailing" traffic conditions, and correcting it to an annual average twenty-four hour day on the basis of known cyclical variations in *volume alone*. The annual average day thus obtained is then expanded to some future design day on the basis of trends in registration, population, land use, etc.

In the so-called external, or cordon, surveys, where the direct route interview method has been extensively employed, various samples have been used as a basis for determining trip patterns and expansions to future design figures. Samples of four, eight, twelve, sixteen, and twenty-four hours, both two-way and one-directional, have been taken as being representative of the 24-hour distribution of trips to various points of origin and destination. Again, it was seldom practicable to interview every driver, due to heavy densities and delays during certain periods of the day. Consequently, varying percentages of drivers passing an interview station during these periods were interviewed, and the sample expanded on the basis of simultaneously made volume and classification counts.

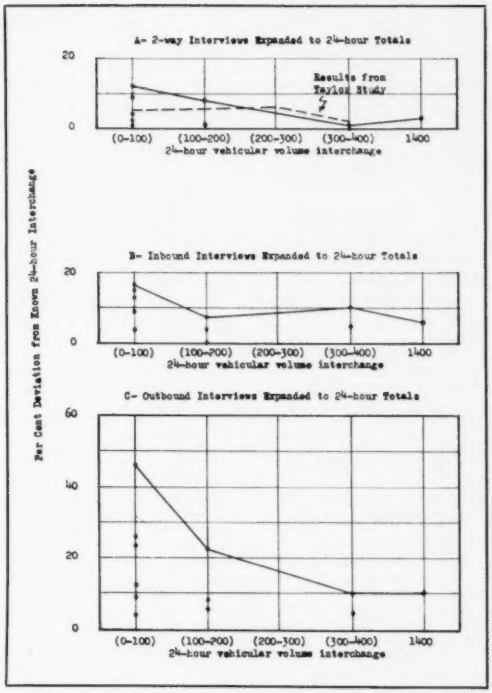


Fig. 1
Results From Origin-Destination Study at Greenwood, Mississippi; 16-hour Interviews (6 A.M. to 10 P.M.)

Need for Accuracy Check

The need for testing the accuracy of data collected was keenly felt, and various indicative checks were employed. Prominent among these is the so-called "screen line" check, in which volume counts are made at natural or man-made traffic barriers and these volumes compared against volumes produced by expanding the interview sample data. Widely varying results were encountered in checking such screen lines.

The desirability of reliable sampling procedures which would produce results of desired degrees of confidence and accuracy has long been evident, but surprisingly little factual research toward demonstrating and establishing such techniques has been published. Increasing complexity and competition between modern traffic facilities accentuates the need for accuracy and confidence in results derived from traffic samples.

Prior Study

In 1948 Carlisle and Taylor published a study begun earlier by Taylor, in which percentage variation in results when trips were sampled for different time periods during a day was factually demonstrated.[1] Interesting and revealing findings resulted from the study, marking the first attempt

Mr. Anderson was a student at the Yale Bureau of Highway Traffic during the academic year 1950-'51, and this article is based on his student thesis research.

[1]Grady Carlisle and W. T. Taylor Jr., "Minimum Time Periods For Origin-Destination Surveys," *Proceedings Highway Research Board 1948*, Vol. 28, pp. 340-347.

to demonstrate on a known basis the comparative results produced by selecting only certain hour periods as a sample rather than the entire twenty-four hours. The study did not attempt to justify statistically the inclusion of certain hours only in the sample, but rather set forth percentage variations from known volumes as they actually occurred.

Comparison With Former Study

The study herewith discussed was undertaken as a corollary to this previous investigation. Additional origin-destination data were tested in a like manner and compared with prior findings before proceeding into some further tests in an effort to indicate the statistical reliability of certain samples. An attempt is also made to demonstrate the applicability of statistical theory to the origin-destination sampling problem.

Data analyzed are from a single external interview station collected by the Planning Division of the Mississippi Highway Department in a typical survey of a town of approximately 20,000 population. A total of 2877 interviews, representing 81 per cent of total 24-hour traffic, is used.

Results from these data do not show close conformity to those of the previous study, but do reveal the tendency for magnitudes of error to decrease as volume ranges increase.

Figure I depicts deviations from known interchange volumes when 16-hour interviews are expanded to 24-hour totals. It is evident that the three expansions produce a wider spread in deviations generally than was the case in the previous findings, and that differences between the limits of variation are greater in the lower volume ranges. The two-way sample expansion yields the best results; the inbound sample compares reasonably well with results from the two-way sample, but the disparity between these and the results from the outbound sample is evident.

This same discrepancy between inbound and outbound trip patterns was evident to a greater degree in the expansions of an 8-hour sample (10 A.M. to 6 P.M.), with the inbound expansion giving slightly better results than even the two-way sample for the eight hours.

Further comparison of inbound and outbound trip distributions is presented in Figure 2. Algebraic signs of the deviations have been indicated in the plotted points, and it may be seen that the inbound sample produces preponderously positive deviations as opposed to an almost correspondingly negative tendency for the out-bound sample. It is of interest to note that both the two-way and inbound expansions of the 16-hour samples (Figure 1) give considerably better results than either of these 24-hour one-directional samples.

Statistical Tests

Question 1:

Are there significant variations in trip pattern during different consecutive time periods of the day?

(a) Are such variations directly associated with magnitudes of volumes occurring during the different hours?

Table I shows computations necessary to the computation of the quantity Chi-square, using trip distributions occurring during successive 8-hour periods of the day. The quantity, Chi-square, is a measure of the degree to which a series of observed frequencies of occurrence deviate from corresponding theoretical or hypothetical frequencies. The theoretical frequencies are set up on the basis of some hypotheses, some rational argument. It has been stated that "wherever, on

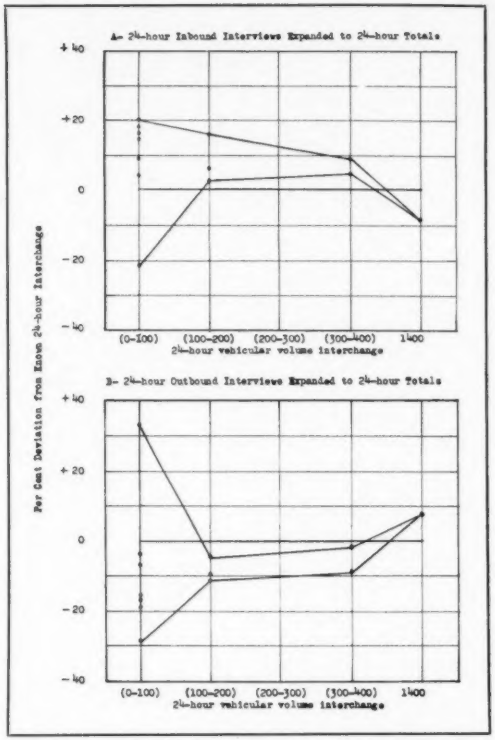


Fig. 2
Results From Origin-Destination Study at Greenwood, Mississippi; 24-hour Interviews.

rational grounds, a set of theoretical frequencies may be derived for comparison with observed frequencies, this test is appropriate in judging the significance of the discrepancy between the two sets of frequencies."[2]

Application of the test is facilitated by use of prepared tables setting forth probability values corresponding to various magnitudes of Chi-square. These values indicate the probability that discrepancies in the two sets of data contributing to the quantity of Chi-square may be attributed to chance, rather than to inherent differences.

Theoretical, or expected, values as shown in Table I were computed by use of proportional factors derived from the relationship of the actual interchange volumes to one another. As may be seen by reference to a table of probability *versus* Chi-square values, the probability is less than 0.01 that discrepancies between expected and actual values may be attributed to chance. Observed discrepancies must therefore be attributed to inherent differences in values. The hypothesis that consecutive 8-hour samples will yield results similar to 24-hour distributions is not borne out. This was evident from previous percentage deviation comparisons of 8-hour expansions with actual known distributions, but here is a significant measure of the *degree* of difference.

Further applying the test to distribution of trips during separate hours to Zone 1 and to remaining points of terminus, it is seen from Table II that probability values cor-

[2]F. C. Mills, *Statistical Methods*, New York, Holt, 1938, p. 626.

TABLE I

CONTINGENCY TABLES COMPARING TRIP PATTERN DURING SUCCESSIVE EIGHT-HOUR PERIODS

Results From External Station 7, Origin-Destination Survey
Conducted at Greenwood, Mississippi—1947

Points of O-D Station	Theoretical Expected Volumes (f)			Actual Volumes (f′)					
	12-8a	8a-4p	4p-12m	12-8a	8a-4p	4p-12		$(f-f')^2/f$	
1	32.0	180.0	105.0	35	187	95	0.3	0.3	1.0
3	35.6	200.5	116.9	51	207	95	6.7	0.2	4.1
Zone									
1	141.4	795.6	464.0	105	834	462	11.0	1.9	0.0
2	6.0	34.1	19.9	5	25	30	0.2	2.4	5.1
3	12.1	68.2	39.7	17	58	45	2.0	1.5	0.7
9	8.8	49.4	28.8	11	33	43	0.5	5.4	7.0
10	17.1	95.9	56.0	23	88	58	2.0	0.7	0.1
11	13.0	73.3	42.7	19	65	45	2.8	0.9	0.1
	266.0	1497.0	873.0	266	1497	873		56.9	

Chi-square equals summation of $\frac{(f-f')^2}{f}$, equals 56.9

Corresponding value of P equals less than 0.01

TABLE II

CONTINGENCY TABLE ASSOCIATING TRIP PATTERN WITH MAGNITUDE OF VOLUME AND HOURS OF THE DAY

Results From External Station 7, Origin-Destination Survey
Conducted at Greenwood, Mississippi—1947

Hour Ending	Total Interviews	Interviews To Zone 1	Interviews To Other Points
1a	21	9	12
2	9	5	4
3	10	1	9
4	15	2	13
5	21	6	15
6	29	6	23
7	79	25	54
8	118	51	67
9	188	95	93
10	214	114	100
11	183	86	97
12n	196	105	91
1p	168	95	73
2	171	98	73
3	222	120	102
4	259	121	138
5	233	113	120
6	206	111	95
7	145	54	91
8	115	60	55
9	84	35	49
10	59	31	28
11	93	39	54
12m	39	19	20
	2877	1401	1476

Chi-square for volume variation = 18.22

Chi-square (residual) = 49.27

Chi-square for variations in proportion = 67.49

Corresponding Values of P less than 0.01

responding to computed values of Chi-square are less than 0.01. Thus the variation between distributions to Zone 1 and to remaining points during different hours may *not* be attributed to chance, but rather is due to inherent differences in distribution during the different hours and a definite association between trip pattern and time of day (and consequently magnitude of volume) is established.

TABLE III

CONTINGENCY TABLES COMPARING INBOUND AND OUTBOUND MOVEMENTS

Results From Station 7, Origin-Destination Survey
Conducted at Greenwood, Mississippi—1947

	Inbound	Outbound	Total
To Zone 1	675	726	1401
A. Remainder	817	659	1476
	1492	1385	2877

$$\text{Chi-square} = \frac{2877\,(817\times726-675\times659-1438)^2}{1492\times1385-1401\times1476} = 14.53$$

Corresponding value of P less than 0.01

	Inbound	Outbound
Total Observed	1492	1385
B. Total Expected	1438	1438

$$\text{Chi Square} = \frac{2\,(53)^2}{1438} = 3.95$$

Corresponding value of P less than 0.05

	Inbound	Outbound
To Zone 1 Observed	675	726
C. To Zone 1 Expected	700.5	700.5

$$\text{Chi Square} = \frac{2\,(25.5)^2}{700.5} = 1.86$$

Corresponding value of P greater than 0.10

Question 2:
Are there significant differences in trip pattern as produced by inbound and outbound movements?

Three tests for conformity of inbound trip pattern to outbound pattern are applied in Table III. Probability values of less than 0.01 and 0.05 and greater than 0.10 result from corresponding computed values of Chi-square. Values of Chi-square giving probability values of less than 0.05 are generally accepted as an indication that discrepancies are too great to be attributed to chance. The hypothesis on the basis of which the comparisons are made, namely that inbound and outbound trip patterns are similar, is therefore suspect, since only one test yields a value greater than 0.05.

The conclusion must be that significant difference in trip distribution does exist in these data, again agreeing with the preliminary comparative analysis.

Question 3:
What results could be obtained if stratified sampling procedures were employed?

Stratified sampling differs from random sampling, in that the population from which the sample is drawn is not treated as a whole but rather is divided into various classes or strata, and sampling is controlled in such a way that a preassigned number of observations is taken from each stratum. *Subsampling* is a further refinement of the stratification method, in which only certain strata are sampled, again taking a predetermined number of cases from each selected stratum. "If stratification is well executed, this insures that any such sample will in general yield more accurate results than a random sample of the same size" taken from the population as a whole.[3]

Cluster sampling is a special case of subsampling in which every case in each stratum selected is included in the sample, instead of only a predetermined number. In each instance the purpose is to control the sample in such a way as to reproduce on a small scale and in their proper relation the characteristics of the entire population. Such measures are especially designed to save time and cost, while yielding a satisfactory and desired level of precision.

With the evidences of the foregoing tests and the implications and intent of stratification in mind, a test of the data arbitrarily employing every fourth hour was made, every possible combination of fourth hours being used. Each of the ratios of trips to Zone 1 to equal trips to all points for the four individual fourth hour samples fell approximately within two Standard Errors of the actual known 24-hour ratio. The indication was that very close to actual 24-hour distribution would have been obtained in this case by sampling only every fourth hour rather than the entire day.

Figure 3 compares interchanges produced by expanding the fourth hour sample beginning at 4:00 A.M. with actual known volumes to various points of terminus. Conformance to the actual trip pattern is seen to be very close, and yet *only one-sixth* of the hours is included in the sample.

Statistics Applied to the Origin-Destination Sampling Problem

The foregoing tests have revealed certain relationships and tendencies in a quantity of data whose characteristics have been defined on a known basis—the sampling of every fourth hour was shown to produce certain results in comparison to a *known answer*. However, the express need is for a sampling procedure with which results can be predicted and controlled without ever knowing or ascertaining the exact characteristics of the entire group of data.

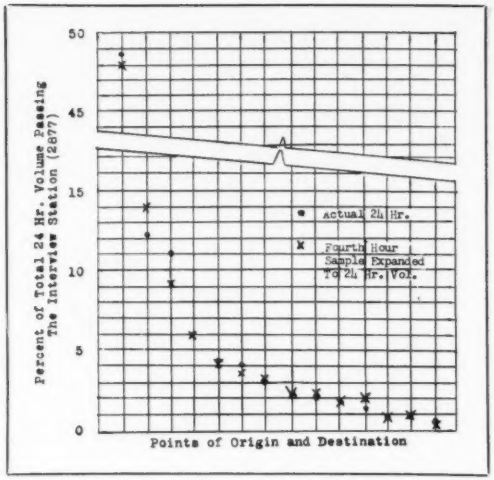


Fig. 3
Comparison of Actual Trip Distribution With Distribution Produced by Expanding Sample of Every Fourth Hour, Beginning at 4 A.M.

Statistical Induction—Inductive reasoning is the logical process by which generalizations are arrived at from a study of particular cases—statistical induction is the generalization of statistical results, the application of measures derived from a sample to the whole mass of data. This is opposed to statistical description, which applies statistical measures to a *mass* of observed data and uses these measures to define the characteristics of the whole group.

Sampling Requirements—Statistical induction demands that the sample from which generalizations concerning the whole are made must be *representative* of the whole. To this end sampling is controlled so that the aggregate of data collected possesses the attributes of the entire mass. Random selection and modifications of stratified sampling as previously discussed are available to satisfy this requirement. If such requirements are met, the measures derived may be extended to include the entire group from which the sample is drawn, with a fairly *definite knowledge* of the *margin of error* involved.

Application—From preliminary investigations and data for a proposed origin-destination survey, degrees of risk and confidence commensurate with a desired level of accuracy together with maximum likelihood estimates may be computed.[4] Samples taken may be tested for reliability and surveys extended for additional data if it appears necessary. Figure 4 illustrates a possible application of statistical theory to the origin-destination problem, in addition to those measures mentioned. Theoretical Standard Deviations which might be expected from various size samples for various magnitudes of interchange volume are computed by the formula and shown as percentages of these volumes.

[3]W. A. Hendricks, "*Mathematics of Sampling*," Special Technical Bulletin, Virginia Agricultural Experiment Station, 1948, pp. 14-23.

[4]T. M. Matson, Unpublished Manuscript, Yale University, 1951, pp. 28-43.

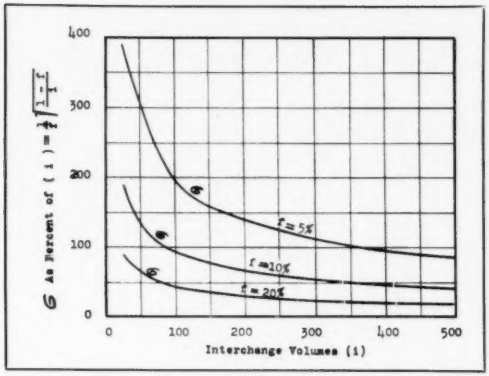


Fig. 4

Theoretical Standard Deviations (g), for Various Sizes of Sample (f), and Various Volumes of Interchange (i).

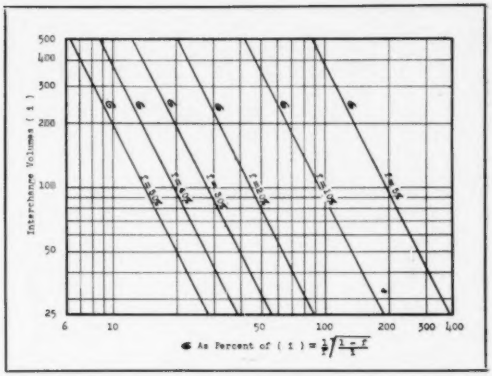


Fig. 5

Theoretical Standard Deviations (g), for Various Sizes of Sample (f), and Various Volumes of Interchange (i).

An increasing tendency toward variation is noted as volumes become smaller, as was evident in the previous tests of actual data. From preliminary data and estimates, a sample size commensurate with a desired level of precision might be determined from such a series of curves. Stratified sampling techniques might be employed to fulfill the requirement of representativeness of sample. Implications in savings of time, cost, personnel, both in the field and in office work, are evident, *and yet the degree of precision desired may be controlled and maintained.* Since the equation is of the second degree, values for any size sample may be quickly determined by computing two points and using logarithmic paper as shown in Figure 5, the curves becoming straight lines.

Summary

Comparative Analysis:—Similarity in general characteristics to data of the previous study is evident, but magnitudes of deviations differ considerably for certain time period expansions. Reliability of a 16-hour sample (6 A.M. to 10 P.M.) is again demonstrated, but differences in inbound and outbound trip patterns for all samples tested would indicate that caution should be used in sampling only one direction of flow.

Statistical Analysis:—There are statistically significant differences in trip distribution to points of origin and destination during different consecutive 8-hour periods of the day—these differences are directly associated with magnitudes of volumes occurring during the different hours, and consequently with the time of day. Inbound and outbound trip patterns do not in this case, conform to the actual observed pattern within allowable limits of accuracy.

Reliable results would have been produced in this case by the inclusion of only every fourth hour in the sample.

Application:—The employment of the principles of statistical induction in the sampling of origin-destination data furnishes the means of predicting and maintaining desired levels of accuracy while utilizing minimum samples, thus saving much time and cost. Increasing costs and competition among modern traffic facilities emphasize the need for such techniques.

(Continued from page 182)

forgotten until very recent years. He is at a distinct disadvantage when required to make his crossings of major streets with no signals other than the normal red, amber and green. Many times through no fault of his own he is trapped in a very hazardous position in the middle of the street.

In Detroit we have started using neon Walk-Don't Walk signals timed specifically to fit pedestrian walking speeds. The first such installation in Detroit was made back in 1939. During the last three years many more have been added. These are operated on a three period basis: "Walk"—flashing "Don't Walk"—steady "Don't Walk." The duration of the flashing Don't Walk period is the time required for a pedestrian to walk from curb to curb at about four feet per second or in other words a clearance period. The Walk comes on at the beginning of the vehicle period and lasts until the flashing period. A pedestrian can leave the curb any time during the walk period and safely reach the far curb. If he is in the street when it starts to flash he still has time to complete his crossing. He is given a plainly visible signal which gives him a definite command.

We have used these at many school crossings as well as others with marked success. In fact we are beginning to receive many requests for them at heavy pedestrian points. The principal criticism involves the flashing "Don't Walk" period. Some confusion as to its meaning has resulted when installations were new. This has soon straightened itself out when people became familiar with the signal. This could be overcome if it were feasible to use a third message for the clearance period.

Conclusions

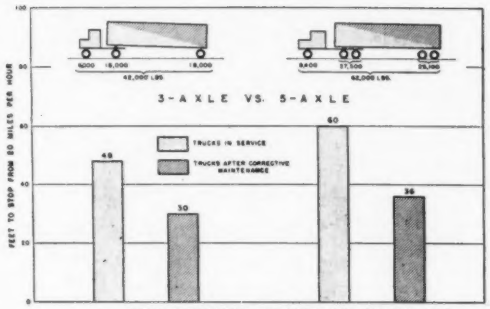
With continuing increases in traffic volumes, the end not yet being in sight, coupled with very slow if any increases in street capacity it becomes of more and more importance to make the most efficient use of our streets. A street is no more efficient than its intersections and a signal automatically reduces the capacity of an intersection for the through street. Every effort should, therefore, be used to have efficient, properly installed signals. The problem merits all the ingenuity we possess.

Brake Performance of Three- and Five-Axle Semi-Trailer Combinations

NOTE: Taken from "A Factual Discussion of Motortruck Operation, Regulation, and Taxation."—Department of Commerce, Bureau of Public Roads, Washington, D. C., 1951.

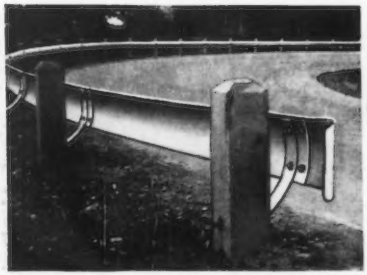
BECAUSE of the possibility it affords of the avoidance of excessive axle loading, the usage of five-axle semi-trailer combinations, wherever practicable, is to be preferred to the use of three-axle combinations. A matter to be considered in this connection, however, is the relative safety of the two types of combination as affected by their relative efficiency of brake performance. The distance required for the stopping of vehicles bears also upon the length of the highway that must be visible to drivers at all times, an important consideration in the geometric design of curvature and gradient.

The comparison shown in the figure, of the average and best performance of brakes of the two types is based on the results of many tests made by the Bureau of Public Roads with the advice of a committee representative of the automotive industry. The stopping distances shown in the figure are those required for stops from a speed of 20 miles per hour. Much longer distances are required for stops from higher speeds, the distance rising approximately with the square of the speed. The stopping distances designated as for "Trucks in Service" were the averages observed for vehicles of the two types and indicated average weights, selected at random from the general traffic. In this instance the stopping distance shown reflects a variety of brake types in various conditions of repair. The stopping distance designated as "Trucks After Corrective Maintenance" were obtained by controlled tests and represent about the best performance that has been observed for the type and weight of the vehicles under consideration.



BRAKE PERFORMANCE OF THREE-AXLE AND FIVE-AXLE TRACTOR-SEMITRAILER COMBINATIONS

It is possible with existing brake mechanisms to apply a braking force to the axles of each unit as it is loaded that would slide the wheels on dry pavement. For this reason, the stopping distance could be the same for each unit if the air or vacuum transmission time (brake lag), inherent in the braking system, were not greater in the five-axle truck-tractor-semi-trailer than in the shorter combination. Progress is now being made toward the reduction of brake lag, but at the present time the larger vehicle appears to require about one-fifth more distance to stop than the smaller vehicle from an initial speed of 20 miles per hour.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New York Plans To Enforce Mileage Tax on Trucks

The New York State Department of Public Works has made public the locations of the first 42 weighing stations which will be constructed in New York State as one of the measures of enforcement of the State's new truck mileage tax which went into effect October 1.

The stations will be operated by the Department of Public Works at the request of the State Tax Commission, which will administer the new tax on heavy trucks.

Highway use permit and mileage tax provisions of the new law apply to every vehicle, using New ork highways, which has a gross weight of more than 18,000 pounds.

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TRAFFIC NEWS

Judge J. W. Hodson (left) Presenting Gift Clock to J. W. Arch Bollong.

Arch Bollong Honored For Traffic Work

High tribute to the work, character and personality of J. W. Arch Bollong (Mem., ITE), Traffic Engineer of Seattle, Washington, who will soon retire, was paid by Civic leaders at a dinner meeting of the Seattle Safety Council on January 23, 1952.

Arch was praised by many leaders including Mayor William F. Devin, Superior Judge James W. Hodson, and Seattle Safety Council President E. C. Walling. The meeting was attended by 71 persons.

"Mr. Bollong has been with the City since 1919," said Mayor Devin. "He is the oldest member of the team working for safety in Seattle. He has received the approbation of his fellow men through the qualities of ability, patience and unquestionable integrity."

Traffic fatalities in Seattle have dropped 31 per cent between 1946 and 1950 compared to the previous five-year period. Mayor Devin credited Arch with doing much to help set this safety record.

In behalf of the Council, Judge Hodson presented Bollong with a clock and cautioned him that he will continue to be called on in an advisory capacity. "This clock is symbolic," said Judge Hodson. "It symbolizes the time you have spent and the time you are going to be called on for advice on traffic and safety measures." The accompanying photograph shows Judge Hodson (left) presenting the gift clock to Bollong.

In addition to the honors conveyed at the dinner, Arch received many congratulatory messages from members of the *Institute* on his past accomplishment and future endeavor. He intends to continue his activities in traffic as Arch Bollong and Associates, Traffic and Transportation Consultants, with offices in Seattle, San Francisco and Los Angeles.

Chamber of Commerce Takes Poll

A poll of varied interests concerned with transportation taken by the Chamber of Commerce of the United States discloses that changes in national transportation policies are believed necessary to strengthen the nation's transportation system.

The poll was taken at the Chamber's Mid-West Transportation Conference held at Cleveland in mid-December. It shows, the Chamber announced, that those attending the conference support these proposed policies:

Establishment of a single national transportation agency, answering directly to Congress, to handle all government regulatory and promotional functions, 69 per cent affirmative vote.

Discontinuance of the practice by government representatives other than regulatory agencies, appearing in rate cases, 87 per cent.

Collection of higher fuel and registration taxes to obtain increased highway construction and maintenance costs, 52 per cent.

Wider latitude for railroad managements in rate making, 79 per cent.

Withholding of federal funds for airport construction where airports are used mostly for local flying activities, 80 per cent.

Liquidation of the Federal Barge Lines, 94 per cent.

State rather than federal regulation of motor vehicle sizes and weights, 62 per cent.

Of the 350 voting in the poll, 53 per cent were carrier representatives; 30 per cent shippers, and 17 per cent other interests.

New Midwest Division Created by Crouse-Hinds

In a recent revision of sales territories, the Crouse-Hinds Company has created a new division known as the Midwest Division comprising the states of Wyoming, Colorado, New Mexico, Oklahoma and part of Texas including the Panhandle, Dallas and El Paso areas. The new division will be under the management of Mr. E. N. Jolliff as Divisional Manager.

Mr. Jolliff was formerly the Dallas, Texas, Regional Manager. His address will continue temporarily to be Crouse-Hinds Company, 512 Thomas Building, Dallas, Texas.

Pigeon-Hole Parking Structure Eases Congestion

Fresh hope is held out for urban motorists, weary of the search for parking space where there is none, as another pigeon-hole parking unit nears completion in Boise, Idaho.

The pigeon-holing device consists of two four-deck structures with a hydraulic elevator running on a track between them. A patron will be able to drive his car into a ground floor "pigeon-hole," (which is a skeleton-like framework of car size), set his brakes, and lock his car. A car-lift platform will then be extended, and will lift the car to the elevator. The elevator will carry the car to the desired level. Then the lift platform will again extend itself, take the car to a specified pigeon-hole, and deposit it.

The builders of the Boise project say the most distant car in the decks can be picked up and delivered to a waiting motorist in 60 seconds. It is possible to build pigeon-holing devices up to six levels, 55 feet wide, and up to any length.

The Boise pigeon-hole structure is a cooperative project by community merchants. First of the devices was built in Spokane last year. Another is being built in Madison, Wisconsin.

High Tribute Paid To Julien Harvey

Julien H. Harvey, pioneer traffic safety specialist and manager of the accident prevention department of the Association of Casualty and Surety Companies since 1938, was honored by leaders of the safety and insurance fields for his numerous contributions to greater safety on the highways and in industry recently at a dinner marking his retirement.

Nearly 75 associates and friends, including many prominent in the fields in which he worked for more than 35 years, attended the dinner which was held at the Waldorf-Astoria Hotel. Tributes to "the father of the 'three E's of safety,'" (education, enforcement and engineering), which Mr. Harvey has always held were of equal importance for any program of safety on the highways or in industry, were expressed by his associates and others.

Wallace Falvey, president, Massachusetts Bonding and Insurance Company, who served as chairman of the advisory committee of Mr. Harvey's department since it was formed in 1937, spoke in behalf of the insurance business in expressing appreciation of his long service. J. Dewey Dorsett, general manager of the Association, and Thomas N. Boate, public safety director and acting manager of the accident prevention department, also paid tribute to Mr. Harvey's effective work, speaking in behalf of the Association and his co-workers, respectively. Both the Association and the employees in Mr. Harvey's department presented farewell gifts.

Ned H. Dearborn, president of the National Safety Council, presented to Mr. Harvey a plaque commemorating his long service with that organization earlier in his career and more recently his tenure as a member of its board of directors.

Among those attending the dinner were Joseph F. Matthai, president of the Association of Casualty and Surety Companies and executive vice-president, United States Fidelity and Guaranty Company; William McKell, former president of the Association and first vice-president, American Surety Company of New York; members of the accident prevention department's committee, and Reginald M. Cleveland, president of the Greater New York Safety Council, which Mr. Harvey served as its first executive vice-president from 1936 to 1938, before he joined the Association.

Mr. Harvey's most recent honor for outstanding work in safety was his election last March as an honorary member of the *Institute of Traffic Engineers*, in recognition of his contributions to the profession of traffic engineering. Only four other living Americans, among them Paul G. Hoffman, president of the Ford Foundation, have been similarly honored. The citation of the board of directors declared "no other person living today has contributed as much of his time, personal effort and financial backing" to the development of the profession.

Mr. Harvey has devoted himself to the traffic and industrial safety fields since 1916. Born in Marshall, Missouri, he abandoned a law career in Kansas City shortly after he was admitted to the bar, when the Traction Company of Kansas City asked him to organize a program to reduce and prevent accidents. It was so successful that in 1916 he helped organize the Kansas City Safety Council and became its first president.

The National Safety Council, learning of his success in forming that group and the Kansas State Safety Council, requested him to organize the nation's first complete safety program in Rochester, N. Y., in 1918. In those early years he promulgated his concept of the "three E's of safety," which has since become the keystone of modern techniques in traffic and industrial safety. His Rochester program was so successful that its effective pattern serves as a model for other community safety programs to this day.

For nine years Mr. Harvey was with the National Safety Council in charge of its organization and promotional activities among local safety councils and as manager of its New York office. After helping to organize and serving as the first paid executive of the Greater New York Safety Council, he left that position to apply his knowledge of accident prevention on a nation-wide scale through the Association of Casualty and Surety Companies, as head of its now famous accident prevention department.

He assisted the Association in founding and financing, in 1938, the Center for Safety Education at New York University, one of the leading institutions of its kind in the nation. Since then he has directed the Association's program to encourage training of youthful drivers in the nation's high schools, the movement to inspect motor vehicles for faulty and unsafe equipment, which to date has taken hold in 14 states and the District of Columbia, and many other efforts to encourage greater safety on the highways and in industry. In 1946, when President Truman decided to convene the President's Highway Safety Conference, Mr. Harvey was one of the nation's ten outstanding traffic experts who was called to Washington to organize the conference. He is still a member of its technical advisory group.

LOOKING AHEAD

MARCH 10-13, 1952—CHICAGO, ILLINOIS
National Electrical Manufacturers Association, Edgewater Beach Hotel.

MARCH 13, 1952—WASHINGTON, D. C.
National Committee for Traffic Safety—Annual Meeting, Hotel Statler.

APRIL 1-4, 1952—NEW YORK, N. Y.
Greater New York Safety Council—22nd Annual Convention, Hotel Statler.

APRIL 28-30, 1952—WASHINGTON, D. C.
Annual Meeting, Chamber of Commerce.

MAY 6-8, 1952—WASHINGTON, D. C.
National Highway Users Conference—4th Highway Transportation Congress.

SEPTEMBER 8-11, 1952—CHICAGO, ILLINOIS
Annual Meeting, Institute of Traffic Engineers, Hotel Sherman.

SEPTEMBER 8-13, 1952—CHICAGO, ILLINOIS
Illuminating Engineering Society National Technical Conference, Edgewater Beach Hotel.

SEPTEMBER 20-24, 1952—ATLANTIC CITY, N. J.
Annual Meeting, American Transit Association.

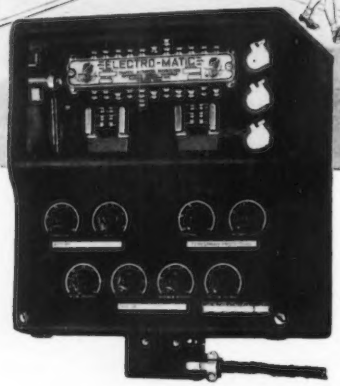
SEPTEMBER 29-OCTOBER 2, 1952—BOSTON, MASSACHUSETTS
Annual Convention, International Municipal Signal Assn., Inc., Hotel Statler.

OCTOBER 20-24, 1952—CHICAGO, ILLINOIS
40th National Safety Congress and Exposition of the National Safety Council.

OCTOBER 22-26, 1952—CHICAGO, ILLINOIS
American Trucking Associations—18th Annual Convention, Stevens Hotel.

NOVEMBER 19, 1952—NEW YORK, N. Y.
34th Annual Meeting, American Standards Association, Waldorf-Astoria Hotel.

NOVEMBER 30-DECEMBER 5, 1952—NEW YORK, N. Y.
Annual Meeting, The American Society of Mechanical Engineers, Statler Hotel.



Who can guess what a kid will do?

Children have a way of sauntering, running, playing, and daydreaming their way across an intersection. It's often safety-necessary to clear the intersection of vehicles. Then there are no cars to turn a corner to endanger young lives . . . and there's no danger of a child's daydreaming landing him in a hospital. Not only children but all pedestrians are endangered at these intersections where heavy vehicle turning movements are present.

Electro-Matic Model 824DN Dispatcher will provide an exclusive pedestrian interval, callable by push button actuation. WALK and clearance intervals are instantly knob-adjusted to desired length.

When pedestrian demand is not present the WALK interval does not appear in the cycle. The 824DN then functions as a semi-actuated dispatcher, right-of-way being normally maintained on the major street unless called to the minor street by vehicle actuation of the detectors.

The flexibility of *full*-actuated control combined with the advantage of a pedestrian WALK interval is obtainable by the Electro-Matic Model 825DN Dispatcher.

To discover how these dispatchers can establish safe conditions at intersections, write for Bulletins 517 and 518.

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Obituary

Frank C. Eisenach, Member, ITE and Assistant Director of the Planning and Traffic Division of the Michigan State Highway Department, Lansing, Michigan, passed away suddenly Wednesday morning, January 30, 1952, at the age of 57.

Frank had been with the Michigan State Highway Department for 16 years. Prior to that time he was engaged in engineering consulting work in Detroit, Michigan, for 18 years. He was a district traffic engineer for the Michigan State Highway Department in charge of the Detroit area when the Willow Run Aircraft Plant was built and the Detroit Industrial Expressway was constructed to provide access to this plant and the surrounding area. His fine work in the traffic control and management of this facility was recognized as an outstanding accomplishment throughout the country.

About eight years ago, Frank was transferred from the Detroit district of the Michigan State Highway Department to the Headquarters office in the Planning and Traffic Division. As Assistant Director he has been in charge of traffic control on all state highways in the State of Michigan.

Mr. Eisenach was a graduate of the University of Michigan. He was a member of the Michigan Society of Professional Engineers, the Lansing Engineers Club, and was a charter member of the Engineering Society of Detroit. He became a member of the Institute of Traffic Engineers in 1944.

Naz-Dar Appoints B. H. Secord as Chief Chemist

Mr. B. H. Secord has been appointed Chief Chemist of the Naz-Dar Company according to Mr. Parmele, Naz-Dar's President. At the same time the research laboratories have been expanded. Equipment to speed the development of new improved inks have been installed. Other apparatus to pre-test inks before making field tests is now being used.

SECTION NEWS

Western Section

The Los Angeles Area Group of the Western Section had a dinner meeting at the Hollywood Roosevelt Hotel in Los Angeles on February 6, 1952. This session, held in conjunction with the Fourth Annual California Street and Highway Conference on the UCLA Campus, had an excellent attendance. Joe Havenner arranged the program and was General Chairman of the Street and Highway Conference. There were several good traffic sessions at the Conference.

* * *

Earle Taylor, District Traffic Engineer for the Fresno district, California Division of Highways, has gone into action after reading President Havenner's plea for more members. He has issued a formal challenge to the other ten district traffic engineers in California to participate in a contest to determine which district traffic department can have the largest percentage of its personnel as members of the ITE by next June. Nick Carter is to be contest judge, with George Webb holding the prize money. Earle suggests that such a contest might be useful also on an interstate basis.

Earle has three or four men filling out ITE application forms already. If all goes well with the membership drive in Fresno and Stockton, Earle and Dick Wilson will set up a San Joaquin Valley ITE Sub-section. By 1953 they expect to bid for the WesternITE Annual Meeting, to be held in either Markleville or Coarsegold.

* * *

From a field of eight applicants from all over the nation, the City Commission of Fresno recently selected Lynn Stewart of Berkeley as the new City Traffic Engineer to succeed Bob Dier who resigned to accept a similar position in the larger city of Long Beach. Lynn assumed his new duties in December. Jim Meyer has taken over Lynn's work in Berkeley.

* * *

Dick Gallagher has been selected as Director of Public Works for the City of San Diego, after being ranked first in the recent Civil Service listing for the position. He left his position as Director of Public Works for Berkeley about January 24, to start his new position.

* * *

Here is Earle Taylor's answer to the $63.98 question (October-November issue): "I claim there was poor advance information as to just when during the national meeting the Western Section annual meeting was to be held. I swear I read everything on ITE that came and didn't see any such announcement. If it was published, it was well buried—and never repeated. So, thinking there was nothing scheduled for Monday morning, I picked that time to drive to L. A. THAT'S MY ALIBI."

* * *

Two one-day traffic engineering conferences were held in San Jose, December 7, and San Mateo, December 14, under the sponsorship of the Institute of Transportation and Traffic Engineering, University of California. These conferences were designed for city managers, city engineers, planning officials, and others with responsibilities in the field of traffic engineering.

Approximately 40 persons attended each meeting. Don Berry and Norm Kennedy served as instructors on such topics as "Traffic Problems and Engineering Approaches in Their Solution," "Relieving Traffic Congestion," "Computing Intersection Capacity," "Correcting High-Accident Locations," "Curb Parking and Loading Control," and "Assigning Responsibility for Traffic Engineering." Each person attending received a 20-page set of notes. Bob Glenn reports that the conferences were a success.

* * *

President Havenner has named L. E. (Bud) George as Area Chairman and Carlton Robinson as Area Activities Chairman for the Oregon Area. Chairmen for other areas will be announced soon. Joe will be glad to have your suggestions.

* * *

Walt Klapproth of Austin (Republic of Texas) reports that Texas is somewhat akin to a fifth wheel on a wagon in the ITE District set-up. It is in the same District as Florida, Georgia and all other Southeastern States which are from 500 to 1500 miles distant. There is no ITE Section in the Southwest. As a result, ITE members all operate more or less independently, without too much knowledge of what the other fellow is doing. So, using Walt's words,—the arrival of "WesternITE" and "Traffic Engineering" is somewhat like the arrival of the mail boats in Alaska between the break-up and the freeze-up.

Walt was interested in the several notices on the success of one-way streets in Oakland, Sacramento, and Salem.

They call them "uni-directional" in Austin. On October 15, Austin installed "uni-directional" movement on 5.5 miles of streets in the Central Business District and in contiguous areas. As in the West Coast cities above, police assistance was not required after the second day of one-way operation. Already there are rumors trickling through to the traffic engineering office that they need one-way movement on several other streets (correction: Uni-directional).

* * *

Gordon Gravelle worked in Los Angeles and San Diego the week of November 17th. Carl Fritts visited in Olympia, Washington, in November. Russ Bates in North Dakota has been forced to purchase six suits of long red flannel underwear.

* * *

A Traffic Safety Lighting Meeting was held in Fresno on December 6, with California Division of Highways' engineers Nick Carter, Dick Wilson, Earle Taylor, Jerry Skiles, Mel West, and Blair Geddes in attendance.

* * *

Bruce Crandall, ITE Vice-President, visited Olympia, Washington, and presented to Governor Arthur B. Langlie and William A. Bugg, Director of Highways, of the State of Washington, the first place plaque for traffic engineering programs for the Group IV states.

* * *

At the ITE dinner in Salem, Bruce Crandall offered to trade Oregon's yellow center-line for California's red stop sign. Val Johnson and Al Head arranged a short get together before the Salem meeting. Johnson and Head proved themselves astute carnival operators. They took merchandise worth $4.41 and with the aid of a teaspoon succeeded in collecting $12.75. Crandall was called to the telephone during the meeting and forced to explain to his home how he could show up at a package store with eighty bucks and be so upset that he overpaid the manager ten bucks!

* * *

Fred Fowler has had a bad cold—lost twenty pounds since the ITE National in September. He and Robbie Robinson have designed a novel system of illuminated signs to reverse lanes on the Steel Bridge in Portland during the morning and evening rush hours. Ralph Kerslake enjoys his new job as City-County Plan Man for the Seattle District office of the Washington Highway Department. Bill Weller is still feeling low as he sees no chance to get to Santa Anita for the races. Jim Gallagher refuses to cross the Columbia to enjoy the Oregon sunshine especially when it comes down at the rate of an inch every hour. Nick Carter goes to Ashland, Oregon, every weekend to mow the lawn even though he must sweep the snow off to do it.

* * *

Western ITE membership on the program of the Highway Research Board Annual Meeting in Washington, D. C., included Ted Forbes, Bob Dunn, Don Berry, Norm Kennedy, and Bud George.

* * *

Coming Meetings

1. Western Association of State Highway Officials, Seattle, June 5, 6, 7, 1952.
2. American Society of Civil Engineers, Denver, June 16-20, 1952.
3. Fifth Northwest Traffic Engineering Conference, Corvallis (May, tentatively).
4. Fourth Businessmen's Conference on Urban Problems, Portland (June 12-13, tentatively).

* * *

What Receptionist in what District Office of what Division of Highways recently received a large box of candy from Skinny DeYoung, allegedly in payment for the small service of taking down and handing him an incoming telegram?

Reported by Donald S. Berry
Secretary-Treasurer

Midwest Section

The First Annual Banquet and Ladies Night of the Midwest Section exceeded all expectations. Almost 90 members, guests and their ladies gathered at the Chicago Engineers Club on January 11, 1952, for the most successful social event in the history of the Midwest Section. The opportunity to get acquainted was enthusiastically seized by all present resulting in an atmosphere of cordiality buoyed by excellent refreshments and capped by delicious steaks and swordfish.

One of the highlights of the banquet was the honoring of Past Presidents of the Section. Ned H. Dearborn presented hand lettered scrolls to Victor G. Hofer, J. Stannard Baker, Matthew C. Sielski and Harry Porter Jr., in recognition of their fine leadership in the formation and development of the Midwest Section.

G. Donald Kennedy keynoted the meeting with a discussion of the 1952 ITE Annual Meeting and its relationship to the Engineering Centennial. Mr. Kennedy, who is Technical Coordinator for the Centennial, outlined briefly some of the activities which will take place during the Convocation, which runs concurrently with the ITE Annual Meeting.

Les Sorenson, General Chairman of the 1952 ITE Annual Meeting, spoke briefly on the fulfillment of a dream of more than twenty years ago. When the *Institute of Traffic Engineers* was organized, said Sorenson, he looked forward to the day when Traffic Engineering and the *Institute* would be accepted on an equal footing with other major engineering branches and societies in the country. This year the ITE has achieved the position Sorenson dreamed of many years ago. He also reminded the ladies that they will have an important part to play in this year's Annual Meeting, especially in connection with planning a complete and interesting women's program.

Special credit for the success of this affair should be given to Pete Page and his Program Committee for the excellent arrangements and organization; to Art Boston for obtaining the tickets and invitations; to Walter Jolesch for the clever place card flags and to Evan Olmstead and his Attendance Committee for having such an enthusiastic turnout.

Reported by Ralph F. Gross
Secretary

New York Section

The third meeting (luncheon meeting) of the 1951-1952 fiscal year was held at the Masonic Club. Twenty-three members and guests were present at this meeting.

The secretary read a letter transmitted to the Greater New York Safety Council offering the cooperation of the local section in helping to plan the program of the annual meeting of the Greater New York Safety Council. Mr. Leslie Williams is to represent the local section in arranging the programs in Traffic Engineering.

It was the consensus of the group that the President of the local section was to dispatch a letter to each of our speakers showing the appreciation of the group for the interesting and enlightening talks that they have presented.

The President appointed Mr. Wetzel to contact the New England Section relative to a combined summer outing this year.

It is expected that in the late spring Mr. Ed Ricker, Traffic Engineer for the New Jersey Turnpike Authority, will arrange a tour of the Turnpike for the local section.

Mr. Harleston asked the opinion of the group relative to support of the legislation requiring vehicle inspection in New York. Mr. Cherniack suggested that Mr. Cyr, the President, appoint a group to study this legislation and report back to him, recommending action to be taken by the local section. Mr. Cherniack suggested caution to the group in supporting legislation of this type.

The principal speaker, Mr. Tom Sullivan, Airport Engineer for the Port Authority, gave a very interesting talk on "Functional Design of Airport Terminals." Mr. Sullivan illustrated with slides the details considered in space requirements, location of concessions, location of parking lots, unloading and loading vehicle space requirements, airport gate positions, etc. The group demonstrated keen interest in this approach to the design of an airport, which resulted in a very interesting discussion which continued until adjournment was required.

It is expected that the local section will submit this paper for inclusion in a future issue of *Traffic Engineering* magazine.

Reported by Lou Bender
Secretary

Thirteenth Annual Southern Safety Conference

The Thirteenth Annual Southern Safety Conference will be held March 2, 3 and 4, 1952, in Atlanta, Georgia. As a part of this Conference, traffic engineering sessions will be held on the afternoons of March 3 and 4, starting at 2:00 P.M.

Topics to be discussed include: Traffic Engineering Training; Sign and Marking Techniques; Control of Driveways; State vs. Local Jurisdictions; Control of Trucks and Buses and New Developments in Traffic Control. Each speaker will present a brief paper designed to provide the framework for *work shop* type of discussion.

For further details concerning the Traffic Engineering Section, or Conference in general, write to Chairman Karl A. Bevins, Traffic Engineer, Atlanta, Georgia.

Secretary's Column

Your Secretary is sorry to report that Mr. Robert S. Holmes, Executive Eecretary, on leave since April, 1951, presented his formal resignation as Executive Secretary at the Board meeting held in Washington, D. C., January 16, 1952. Bob expressed regret that his duties with the Federal Civil Defense Administration prevent his return to the *Institute*. In asking the Board to accept his resignation, he offered his full cooperation as a member of the *Institute*, and indicated a deep interest in all future ITE activities. The Board accepted the resignation by acknowledgement of the service performed by Mr. Holmes, including the expansion of the *Institute's* activities, membership and professional recognition during his operation of National Headquarters. The *Institute* owes a debt of gratitude to Bob. It is fortunate that a man of his ability and foresight became our first full-time Executive Secretary.

Copies of the revised edition of Technical Report Number 1, "Adjustable Face Traffic Control Signal Head Standards" are now available for distribution. This revised standard was approved by the American Standards Association on November 27, 1951. Gratis copies are being mailed to *Institute* members: Others may obtain copies by writing to the Institute of Traffic Engineers, Strathcona Hall, New Haven, Connecticut, for Technical Report No. 1, D10.1, 1951, sending remittance of 50c per copy.

The 1951 Proceedings of technical reports and papers presented at the 22nd Annual Meeting were mailed to the membership recently. Others wishing to obtain copies may procure them from *Institute* Headquarters (address above), for $2.25 per copy.

Increases in the number of subscriptions for *Traffic Engineering* have been very gratifying. Please send in your suggestions for improvements in the magazine, and remember to send us technical papers, news and other items which you believe will be of interest to subscribers.

Position Available

DENVER, COLORADO

ASSISTANT
TRAFFIC ENGINEER

At least two years of experience in urban traffic engineering. Graduation from a 4 year college or university with specialization in civil engineering preferably supplemented by courses in traffic engineering.

Starting salary range $419-$525 depending upon qualifications.

Apply: City and County of Denver, Budget and Personnel Department, City and County Building, Denver. Address communication to the attention of R. W. Fennig, Recruitment Officer (or write to Henry A. Barnes, Director, Traffic Engineering Division, City and County Building).

State Model Traffic Ordinance Approved For Colorado Cities

Colorado cities now have a model ordinance they can adopt by reference to bring their traffic laws in line with uniform national standards. Through a law passed by the state legislature in 1949, Colorado became the first state to permit its constituent cities to adopt a state model traffic ordinance by reference, obviating the necessity for local publication and saving the cost of this legal requirement.

Recently, the Colorado Municipal League and the Colorado Highway Safety Council placed final stamp of approval on a model ordinance drafted jointly by the two organizations. State official approval also has been given and the model is officially recommended for adoption by cities. The model is in two parts, one covering administration and the other dealing with rules of the road. Cities may adopt it either in whole or in part by reference.

The Colorado model conforms with the nationally recognized Model Traffic Ordinance and is geared to Colorado state law.

Mayor John L. Sullivan says:

"The New Britain Parkades have solved a 25-year parking problem and won the enthusiastic approval of business and citizens alike. Just as important, they have provided adequate parking facilities on a financially sound basis that actually earn revenue for the city instead of adding to the tax burden."

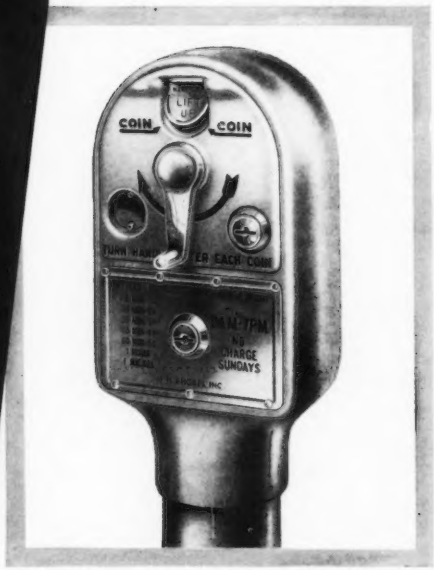
New Britain, Connecticut
solves
DOWNTOWN PARKING PROBLEM
with

PARKADES*

using

MARK-TIME

"HURRICANE"
PARKING METERS



Here is the practical, financially-sound solution to today's acute parking problem. New Britain's system of centrally located Parkades provides convenient, speedy parking for 750 cars. Revenue from the Mark-Time meters — installed in all the Parkades—will exceed the cost of financing the program and give the city a large return on its investment. Dependable, manually-operated Mark-Time "Hurricane" Parking Meters are the key to the Parkade system of municipally-owned off-street parking areas . . . assuring continuous, trouble-free service year after year . . . with a minimum of attention for service and upkeep.

Write for the complete story of the New Britain Parkades. Traffic advisory service available without obligation.

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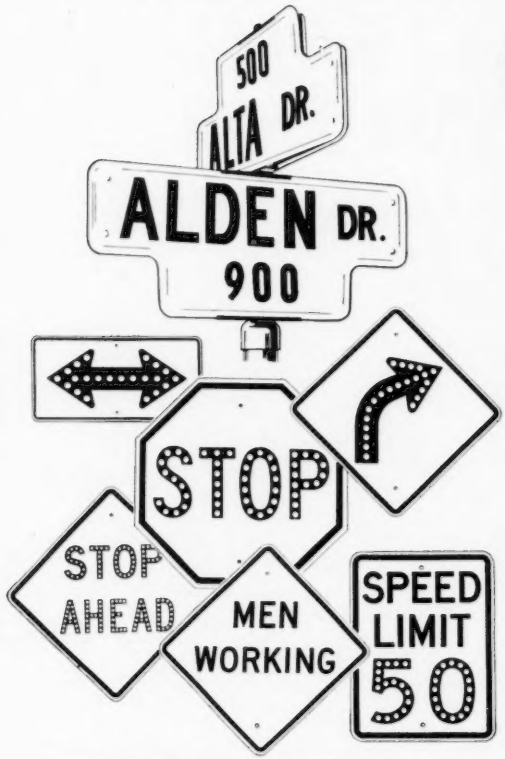
M. H. RHODES, INC.
HARTFORD, CONNECTICUT

MARK-TIME

TO EFFECTIVE

TRAFFIC CONTROL.....



Grote SIGNS

Here are high-visibility signs for practically every traffic control need; Street name plates for instant recognition of name and number; parking signs that politely enforce traffic control; road signs to improve highway safety. Built for years of dependable, long-wear service, all GROTE Signs are made of heavy, zinc coated, Bonderized steel, finished with special baked enamel processes that make them permanently bright and attractive — that resists the action of weather, salt spray, smoke or airborne chemicals. All are made to the Grote high standards of manufacture and conform to the accepted official standards and recommended uniform sign systems. For economy purchase and installation, always specify Grote Signs.

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gives you an optical system that

remains CLEAN *inside* . . .

• Greater light output
• Increased visibility
• Lower maintenance

You get all of these benefits when you install Crouse-Hinds Dust-Tight Traffic Signal . . . the signal with the optical system which retains its peak efficiency indefinitely, under all conditions of atmosphere and climate . . . the signal with the built-in barriers through which dust CANNOT PASS:

TWIN-RING MOLDED RUBBER DUST SEAL . . . especially designed to perform the vital function of resealing the optical system when it is opened for servicing. When the door is closed each of the two rings is compressed against the aluminum reflector ring, giving you not just one but two dust-repelling seals. It not only makes the optical system dust-tight . . . it also serves as a gasket for the lens. This vitally important seal is made of synthetic rubber with the proper degree of softness, molded in one piece . . . not extruded and spliced together. It will withstand temperatures 100 degrees higher than any encountered in the optical system . . . it will not become hard or brittle, nor will it become tacky and stick to any of the parts.

REFLECTOR RING . . . Half-hard aluminum 1/16-inch thick, formed to provide a flat, rigid surface against which the twin-ring dust seal is compressed. It is so shaped that the reflector gasket is held firmly in place.

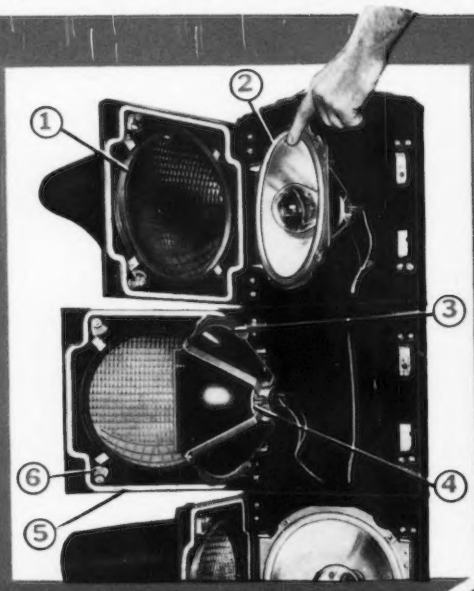
REFLECTOR GASKET . . . Cork, punched from a solid sheet . . . not spliced at any place. It fits tightly in the back of the reflector ring and will not fall out. This gasket provides a perfect seal against the ground edge of the reflector.

RECEPTACLE GASKET . . . Cork, punched from a solid sheet . . . not spliced at any place. It fits tightly around the smooth surface of the molded composition lamp receptacle, and is held firmly against the apex of the reflector by a metal washer.

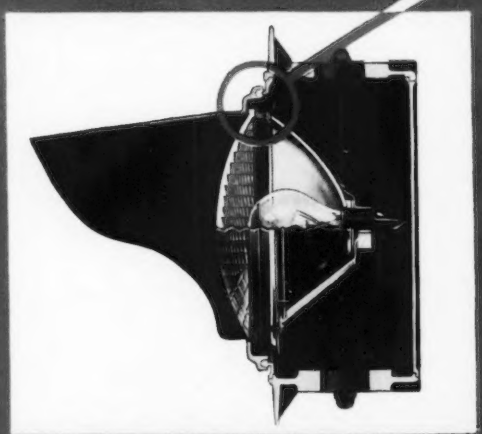
RESILIENT DOOR GASKET . . . Cemented into the gasket groove of the door, and is closed against a raised bead on the signal housing. This gasket will not become hard or brittle, and retains its resiliency indefinitely.

TWO DOOR CATCHES . . . Two cam-acting lever catches which, when turned approximately 90 degrees, fasten the door securely, thus excluding all dirt, dust, and moisture. The cam-acting catches bear against the inner surface of the signal housing and lock the door tightly against the gasket.

The Dust-Tight Traffic Signal is built to Crouse-Hinds high standard of quality . . . from the finest materials, with painstaking care, by skilled craftsmen. Write for additional information on this outstanding development in the traffic engineering field.



Type TSO-113DT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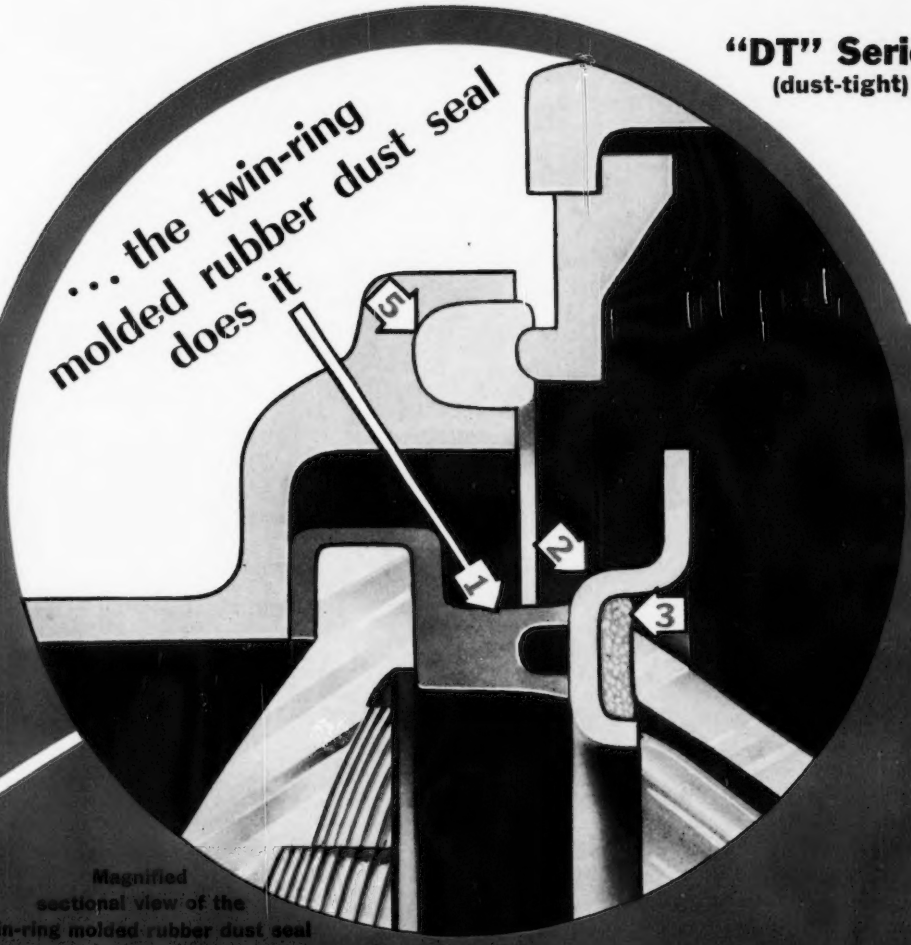
"DT" Series
(dust-tight)

. . . . . the twin-ring molded rubber dust seal does it



Magnified sectional view of the twin-ring molded rubber dust seal

Built-in Barriers Through Which Dust CANNOT PASS

1. **TWIN-RING DUST SEAL** . . . . makes double contact with the reflector ring . . . . gives double protection . . . . also serves as lens gasket.
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3. **CORK REFLECTOR GASKET** . . . . gives a dust-tight joint at the reflector edge.
4. **CORK RECEPTACLE GASKET** . . . . completely seals the receptacle opening.
5. **RESILIENT DOOR GASKET** . . . . makes the housing weather-proof.
6. **DOOR CATCHES** . . . . two on every door insure uniform pressure against the door gasket and the twin-ring seal.

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Plans Being Made for Highway Test in Idaho

Plans are reported to be progressing satisfactorily toward the initiation of a road test in Idaho sponsored by the twelve member states of the Western Association of State Highway Officials. The Bureau of Public Roads will participate in the project and there is expected to be some participation by segments of the highway transportation industry. The project will be handled by the Highway Research Board through an advisory committee including representatives of participating agencies.

The Idaho Road Test will be made on a road section constructed for that purpose, and will not be thrown open to regular highway use until the test is completed. This test will be made on flexible type pavement as contrasted with the portland cement pavement on which the recent Maryland test was made. It is contemplated that the Idaho test road will have three variations in pavement standard on each of which vehicles with different axle loads will be separately tested. For example, 18,000 lb. axle loads would be run over three sections of road, one built to reflect general current practice in the West, one a somewhat lower standard, and the last a somewhat higher standard. Similar road sections would be tested under other axle loadings for single and tandem axles.

Sponsors of this and other road tests expect they will provide much valuable information to engineers for use in the planning of highways to serve best the overall interests of motor transportation.

MEMBERSHIP INFORMATION

may be obtained by writing to:

Executive Secretary

Institute of Traffic Engineers

Strathcona Hall

New Haven 11, Connecticut

30 Million Passenger Cars is U. S. Wartime Need, Study Reveals

In event of immediate general war, the United States would need to maintain 30 to 31 million of the present 40 million automobiles to provide service comparable to that in the last war, according to a study by Wilfred Owen, of the Brookings Institution, for the Defense Transport Administration.

"The absolute minimum level of ownership that could be contemplated today without serious disruption of the economy would be in the neighborhood of 26 million cars," Mr. Owen concludes. He anticipates the need once again of strict mileage rationing, depending on fuel supplies, and the need for an adequate stockpile of replacement parts to keep the cars in operation. A desirable minimum wartime objective, from the standpoint of transportation, would be production of cars at a level sufficient to replace those 10 years old or older, he says.

Meanwhile, he advises, today's fleet of automobiles should be built up to maximum quality. "The large volumes of unused mileage in the cars operating in 1941," he says, "was a major factor in the successful maintenance of automobile transportation during four years of no production and the ensuing period of continuing automobile scarcity. Today the presence of millions of over-age cars in the automobile fleet represents an inventory weakness which should be corrected to the extent possible."

Joint Planning and Traffic Session Planned For ASCE Spring Meeting In New Orleans

The *Institute of Traffic Engineers* is cooperating with the Planning Division of ASCE in a joint session to be held on March 6-7, 1952, at the ASCE Spring Meeting in New Orleans. Mr. D. Grant Mickle, Director, Traffic Engineering Division, Automotive Safety Foundation, Washington, D. C.; Lloyd Braff, City Traffic Engineer, Dallas, Texas, and Mr. Kenneth King, City Traffic Engineer, New Orleans, are *Institute* members who will take part in the program.

This joint session is only part of the Spring Meeting which will be held from March 5-7. Engineers and their families going to New Orleans for the Meeting are assured a program of outstanding technical, social, and historic interest. Since the Convention is the first to be held in the ASCE Centennial year, the program will include special features celebrating the occasion. Headquarters for the Convention will be the St. Charles Hotel, located in the commercial center of the city.

Technical sessions of both national and regional concern are being planned by all but one or two of the Society's fourteen Technical Divisions. In the former category there will be a general session devoted to engineers' activities in the Civil Defense Program. Several of the Divisions are sponsoring tours of engineering projects under way—expressways, sanitary facilities, and new industrial plants—for the civic betterment and commercial expansion of the city.

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AUTOMATON automatic original in beauty, in automatic performance, and in engineering principle. • No guessing how much to wind, no wondering if a city employee has wound a spring beforehand to make it automatic. • Only after you've seen model A-1 AUTOMATON energized by insertion of a coin only, then and only then can you appreciate the sheer magic of its automatic operation. • AUTOMATON offers more modern advantages than any other automatic meter for maintenance savings, and more net revenue to the city.

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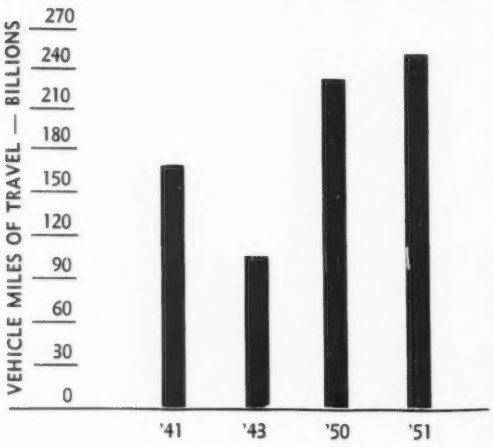
Traffic Trends



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Yale Bureau of Highway Traffic

Wisconsin State Highway Commission.

Highway Traffic in Wisconsin Cities. The Commission, 1950.

Wisconsin Highway Traffic. The Commission, 1950.

Two surveys conducted with the cooperation of the U. S. Bureau of Public Roads.

**Utah. University of.
Department of Civil Engineering**

Proceedings of the Twelfth Annual Highway Engineering Conference. Bulletin No. 52 of the Utah Engineering Experiment Station and Vol. 41, No. 1, April, 1951 of the University of Utah.

Contains papers on economic problems of highway building, on highway planning and on motor vehicle sizes, weights, loads, etc., as well as on highway construction.

Michigan Joint Legislative Committee on Reorganization of State Government.

Better Relations Between the Motorist and His Government; a Pilot Study of Driver and Vehicle Services; Staff Report to the . . . Committee . . . The Committee, 1951. 41p., tables, graphs, illus.

Final report on the "first broad-scale study of motor vehicle administration in the United States." The study was made under the direction of Joe E. Mattson and with the cooperation of the Automotive Safety Foundation.

National Committee for Traffic Safety.

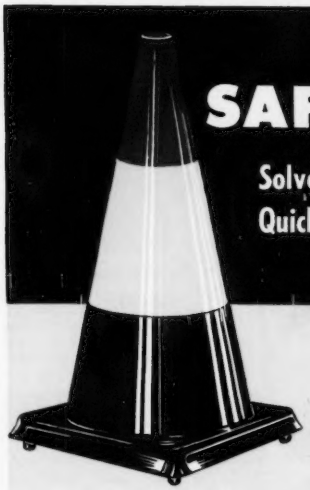
How to Promote and Publicize a Safety Meeting; a Step by Step Guide. By Howard Bonham, Harry A. Williams and others. Edited by John W. Gibbons. The Committee, 1951. 35p., pamphlet.

A discussion of the value and the methods employed in promotion and publicity as important factors in enlisting support for traffic programs.

National Highway Users Conference.

Roads to National Security. The Conference, 1951. 32p., pamphlet, charts, tables, graphs.

Graphic study of motor transportation in this country.



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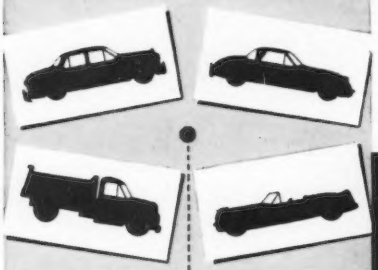

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